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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N74-18642 Texas A&M Univ., College Station.
A NUMERICAL VORTEX BOX TECHNIQUE FOR CALCULATIONS IN LIFTING SURFACE THEORY Ph.D. Thesis
Garry Owen Hawkins 1973 216 p
Avail: Univ. Microfilms Order No. 74-1013

The method derives its working form directly from the physical interpretation of the basic equation from which all solutions in subsonic wing theory are developed. The method is formulated for both the two and three-dimensional cases, with the working form generated from comparisons with the known exact value for a flat plate at incidence. Results are generated in the three-dimensional case for rectangular wings and swept wings of various aspect ratios. The general conclusion is reached that the method compares very well with the known exact solution in the two-dimensional case and with the various solutions in the three-dimensional case. The present method is physically justifiable due to the fact that it is obtained directly from the general equation of wing theory. Dissert. Abstr.

N74-18643 Ohio State Univ., Columbus.
STUDY OF THE ELECTROSTATIC FIELD AND CHARGE DISTRIBUTION IN A VORTEX SEEDED WITH DUST Ph.D. Thesis
John William Daugherty 1973 354 p
Avail: Univ. Microfilms Order No. 73-26795

An experimental program was undertaken to investigate the vortex geometry, particle distribution and electric field distribution in a trailing vortex shed from an airfoil tip placed in a dust laden flow. A differential airfoil, positioned in a subsonic wind tunnel, generated the trailing vortex. Dust conditions, typical of a helicopter landing zone, were simulated by seeding the wind tunnel flow with P.V.C. plastic pellets, no. 3 sand, and no. 120 sand. An airbearing vortex probe was designed and constructed for use in measuring the vortex geometry. The probe was calibrated over a range from 0 to 12,000 R.P.M. The airbearing vortex probe was found to be unaffected by free stream conditions. A particle impact probe and a miniature field meter were used to map the particle distribution and electric field distribution across the trailing vortex. Vortex geometry particle distribution and electric field intensity were measured throughout the plane normal to the wind tunnel axis at several locations downstream from the airfoil. Dissert. Abstr.

N74-18644# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
IMPLICIT MODEL DECOUPLING APPROACH TO VTOL FLIGHT CONTROL DESIGN
David Rothschild and Eliezer Kreindler (Technion, Israel Inst. of Tech., Haifa) Jan. 1974 39 p refs
(RE-469) Avail: NTIS HC $5.00

The results of a preliminary study to determine the feasibility of applying a flight control design technique based on linear optimal control for decoupling the longitudinal dynamic modes of a VTOL jet at low speed and hover are presented. To alleviate the pilot's task of maintaining a stable attitude, or carrying out specific types of maneuvers at critically low speeds, the design objective formulated is to provide the pilot with only three controls with which to maneuver the vehicle independently in pitch angle and forward and normal velocities. The implicit model following approach was employed to synthesize the feedback and feedforward gain solutions corresponding to various levels of handling quality performance and control authority limitations.
Author

N74-18645*# United Aircraft Corp., East Hartford, Conn. Research Labs.
EXPERIMENTAL INVESTIGATION OF MODEL VARIABLE-GEOMETRY AND OGEE TIP ROTORS Final Report
Anton J. Landgrebe and E. Dean Bellinger Washington NASA Feb. 1974 114 p refs
(Contract NAS1-10906)
(NASA-CR-2275) Avail: NTIS HC $4.50 CSCL 01A

An experimental investigation was conducted to systematically explore the effects of inter-blade spatial relationships and pitch variations on rotor performance and wake geometry. Variable-geometry rotors consisting of various combinations of blade length, axial spacing, azimuth spacing, and collective pitch were tested at model scale in hover and forward flight. In addition, a hover test of a model rotor with an ogee blade tip design was conducted to determine its performance and wake characteristics. The results of this investigation indicate that properly selected variable geometry rotor configurations can offer substantial improvements in hover performance without adversely affecting forward flight performance. Axial spacing of alternate blades was found to provide the greatest performance benefit, and further improvements were achieved by combining azimuth spacing with axial spacing. The performance benefit appears to be related to the relief of local adverse aerodynamic phenomena produced by vortex interference. The ogee tip design was found to substantially reduce the concentrated core intensity of the tip vortex, and could thus prove beneficial for the relief of blade-vortex interaction problems. However, the ogee tip was found to reduce hover performance at model scale.
Author

N74-18646*# Avco Corp., Wilmington, Mass. Systems Div.
INVESTIGATION OF NONLINEAR INVISCID AND VISCOUS FLOW EFFECTS IN THE ANALYSIS OF DYNAMIC STALL Final Report
Peter Crimi Washington NASA Feb. 1974 114 p refs
(Contract NAS1-11245)
(NASA-CR-2335) Avail: NTIS HC $4.50 CSCL 01A

A method for analyzing unsteady airfoil stall was refined by including nonlinear effects in the representation of the inviscid flow. Certain other aspects of the potential-flow model were reexamined and the effects of varying Reynolds number on stall characteristics were investigated. Refinement of the formulation

improved the representation of the flow and chordwise pressure distribution below stall, but substantial quantitative differences between computed and measured results are still evident for sinusoidal pitching through stall. Agreement is substantially improved by assuming the growth rate of the dead-air region at the onset of leading-edge stall is of the order of the component of the free stream normal to the airfoil chordline. The method predicts the expected increase in the resistance to stalling with increasing Reynolds number. Results indicate that a given airfoil can undergo both trailing-edge and leading-edge stall under unsteady conditions. Author

N74-18647*# United Aircraft Corp., East Hartford, Conn.
FINITE-DIFFERENCE SOLUTION FOR TURBULENT SWIRLING COMPRESSIBLE FLOW IN AXISYMMETRIC DUCTS WITH STRUTS Final Report
O. L. Anderson Washington NASA Feb. 1974 154 p refs
(Contract NAS3-15402)
(NASA-CR-2365; L911211-1) Avail: NTIS HC $5.00 CSCL 20D

A finite-difference procedure for computing the turbulent, swirling, compressible flow in axisymmetric ducts is described. Arbitrary distributions of heat and mass transfer at the boundaries can be treated, and the effects of struts, inlet guide vanes, and flow straightening vanes can be calculated. The calculation procedure is programmed in FORTRAN 4 and has operated successfully on the UNIVAC 1108, IBM 360, and CDC 6600 computers. The analysis which forms the basis of the procedure, a detailed description of the computer program, and the input/output formats are presented. The results of sample calculations performed with the computer program are compared with experimental data. Author

N74-18648*# Aerospace Corp., El Segundo, Calif.
AN EXPERIMENTAL STUDY OF THE VALIDITY OF THE HEAT-FIELD CONCEPT FOR SONIC-BOOM ALLEVIATION Final Report
Rudolph J. Swigart Washington NASA Mar. 1974 80 p refs
(Contract NAS1-10051)
(NASA-CR-2381; ATR-74(7218)-1) Avail: NTIS HC $4.00 CSCL 01A

An experimental program was carried out in the NASA-Langley 4 ft x 4 ft supersonic pressure tunnel to investigate the validity of the heat-field concept for sonic boom alleviation. The concept involves heating the flow about a supersonic aircraft in such a manner as to obtain an increase in effective aircraft length and yield an effective aircraft shape that will result in a shock-free pressure signature on the ground. First, a basic body-of-revolution representing an SST configuration with its lift equivalence in volume was tested to provide a baseline pressure signature. Second, a model having a 5/2-power area distribution which, according to theory, should yield a linear pressure rise with no front shock wave was tested. Third, the concept of providing the 5/2-power area distribution by using an off-axis slender fin below the basic body was investigated. Then a substantial portion (approximately 40 percent) of the solid fin was replaced by a heat field generated by passing heated nitrogen through the rear of the fin. Author

N74-18649# Aircraft Research Association, Ltd., Bedford (England).
THE EFFECT OF MILD REAR FUSELAGE UPSWEEP ON REAR FUSELAGE LOADS AND PRESSURE DISTRIBUTIONS FOR A SWEPT WING-BODY COMBINATION AT SUBSONIC SPEEDS
D. Morton Mar. 1974 22 p
(Contract KC/49/15)
(ARA-34) Avail: NTIS HC $4.25

Tests were made over the range 0.5 much smaller than M much smaller than 0.9 to determine the effect of rear fuselage upsweep typical of an airbus aircraft, on the loads and pressure distributions on the rear fuselage. The drag due to upsweep increased with M and decreased with increase of alpha. The upsweep reduced the drag for alpha larger than 4 deg at M = 0.5. At a typical cruise condition the drag penalty due to upsweep would be about 2% of the total aircraft drag. The measured pressures on the symmetrical rear fuselage along upper and lower center lines show good agreement with those calculated by inviscid potential flow theory on an equivalent axisymmetric body. Author

N74-18650*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD-AIR ANNULAR-CASCADE INVESTIGATION OF AERODYNAMIC PERFORMANCE OF COOLED TURBINE VANES. 1: FACILITY DESCRIPTION AND BASE (SOLID) VANE PERFORMANCE
Louis J. Goldman and Kerry L. McLallin Washington Mar. 1974 32 p refs
(NASA-TM-X-3006; E-7699) Avail: NTIS HC $3.25 CSCL 20D

The aerodynamic performance of a solid vane was experimentally determined in a full-annular cascade, where three-dimensional effects could be obtained. This vane was of the same size and profile as the cooled vanes to be subsequently tested. The vanes were tested over a pressure ratio range that corresponded to mean-radius ideal aftermixed critical velocity ratios of 0.71 to 0.89. Overall vane aftermixed efficiencies were obtained over this range of critical velocity ratios and compared with results from a four-vane annular-sector cascade. The variation in vane aftermixed conditions and vane aftermixed efficiency with radius were also obtained and compared with design values. Vane surface static-pressure distributions were measured and compared with theory and with the results obtained in the four-vane cascade. Author

N74-18651*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODIFICATION OF A THREE-DIMENSIONAL SUPERSONIC NOZZLE ANALYSIS AND COMPARISON WITH EXPERIMENTAL DATA
Allan R. Bishop and Bobby W. Sanders Washington Mar. 1974 23 p refs
(NASA-TM-X-3025; E-7486) Avail: NTIS HC $3.00 CSCL 20D

A computer program previously developed to analyze three-dimensional supersonic nozzles by the method of characteristics has been modified to study less restrictive nozzle geometries and nonuniform inlet conditions. An example indicates that a one-dimensional calculation that uses an averaged initial profile may be significantly in error. A comparison between the analysis and the data from a three-dimensional experiment shows generally good agreement between the two. Author

N74-18652*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMMENTS ON NASA LANGLEY RESEARCH ON TRANSONIC UNSTEADY AERODYNAMICS
Samuel R. Bland Paris AGARD Dec. 1973 14 p refs Presented at 36th AGARD Structures and Mater. Panel Meeting, Milan, 4 Apr. 1973
(NASA-TM-X-69997; AGARD-R-611) Avail: NTIS HC $4.00 CSCL 01A

Accurate unsteady transonic aerodynamics for use in flutter calculation are considered. Five different methods of analysis are described, each of which attempts to treat some of the nonlinear aspects of the transonic flow. Where possible, calculated results are given. Author

N74-18653# Advisory Group for Aerospace Research and Development, Paris (France).
ON THE PREDICTION OF AERODYNAMIC LOADS ON OSCILLATING WINGS IN TRANSONIC FLOW
H. Tijdeman (Natl. Aerospace Lab., Amsterdam) and R. J. Zwaan (Natl. Aerospace Lab., Amsterdam) Jan. 1974 30 p refs Presented at 36th AGARD Structures and Mater. Panel Meeting, Milan, 4 Apr. 1973
(AGARD-R-612) Avail: NTIS HC $4.50

Possibilities to develop calculation methods for oscillating wings in transonic flow are discussed. Special attention is given to the question of linearization. Pressure measurements on an aerofoil with flap in transonic flow are analyzed. Correlations are made between steady, quasi-steady and unsteady results. Shock motion and shock strength are investigated. Also linearity

is discussed. A calculation method for high subsonic flow is suggested. Author

N74-18654# Advisory Group for Aerospace Research and Development, Paris (France).
INTERFERING LIFTING SURFACES IN UNSTEADY SUBSONIC FLOW: COMPARISON BETWEEN THEORY AND EXPERIMENT
Juergen Becker (Messerschmitt-Boelkow-Blohm, Munich) Jan. 1974 20 p refs Presented at 37th AGARD Structures and Mater. Panel Meeting, the Hague, 7-12 Apr. 1973
(AGARD-R-614) Avail: NTIS HC $4.00

The results of experimental and analytical research work on the flutter with complete aircraft models showed considerable shifting of critical flutter speeds due to interfering aerodynamic forces, particularly where models of variable geometry were concerned. This was the reason for the development of aerodynamic interference procedures for two or more oscillating surfaces. In order to calculate interfering aerodynamic forces, theoretical procedures were developed which may be divided into lifting surface theories and double lattice methods. Measurements of unsteady pressure distributions on a variable wing-tail configuration, were compared with the results of the lifting surface theory. Author

N74-18655# Aeronautical Research Labs., Melbourne (Australia).
FORTRAN PROGRAMS FOR THE DETERMINATION OF GENERALISED AIR FORCES ON INTERFERING LIFTING SURFACES OSCILLATING IN SUBSONIC FLOW
P. A. Farrell Aug. 1973 83 p refs
(ARL/SM-Rept-345) Avail: NTIS HC $7.25

The unsteady aerodynamic forces by the oscillating motion of a wing are analyzed. The wing is idealized as a thin flat plate oscillating in a potential flow. A modification of the doublet lattice theory has been programmed to calculate the unsteady, generalized aerodynamic forces acting on interfering lifting surfaces in subsonic flow. An outline of the relevant theory is given. The limitations and usage of the computer programs are described. Results are compared with those of other theoretical methods. Author

N74-18656*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIND TUNNEL BLOCKAGE AND SUPPORT INTERFERENCE EFFECTS ON WINGED-BODY MODELS AT MACH NUMBERS FROM 0.6 TO 1.0
Bernard J. Blaha Washington Mar. 1974 36 p refs
(NASA-TM-X-3011; E-7596) Avail: NTIS HC $3.25 CSCL 01A

Three sting-mounted winged-body models with tunnel blockages of 0.1, 1.0, and 2.0 percent were tested in the Lewis Research Center's 8- by 6- Foot Supersonic Wind Tunnel. Fuselage pressures were obtained over a Mach number range of 0.6 to 1.0 at angles of attack from 0 deg to 4 deg. Two other types of model support were investigated, which included simulated wing-tip and fuselage support-strut mountings. The effects of tunnel porosity and sidewall geometry were also investigated. Model blockage effects were small up to M sub 0 = 0.95. At higher speeds the major blockage effect observed was a displacement of the local transonic terminal shocks on the model. The effects of the wing-tip type of model support were small up to M sub 0 = 0.95, but disturbances were observed on the fuselage at higher speeds. Changes in local tunnel porosity were effective in reducing the disturbances up to M sub 0 = 0.975, but a change in sidewall geometry was not. Author

N74-18657*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT-TEST INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS AND FLOW INTERFERENCE EFFECTS ABOUT THE AFT FUSELAGE OF THE F-111A AIRPLANE
Norman V. Taillon Washington Feb. 1974 77 p refs
(NASA-TN-D-7563; H-717) Avail: NTIS HC $4.00 CSCL 01A

Static pressure measurements were made on the aft fuselage of an F-111A airplane to determine local flow characteristics and engine/airframe interaction effects. Data were obtained over the Mach number range from 0.5 to 2.0. Aspiration effects associated with low ejector nozzle expansion ratios reduced the local pressure coefficients particularly on the interfairing but also extending to the trailing edge of the nacelle. The presence of afterbodies also affected the behavior of the air flowing into and about the ejector nozzle. Pressures about the aft fuselage were improved by an increase in primary nozzle area at a supersonic speed. A comparison of wind-tunnel and flight-test results showed generally good agreement, although there was a large disparity in pressure level about the ejector nozzle. However, the shape of the data curves and the local flow behavior were basically similar. Author

N74-18658*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRESSURE DISTRIBUTION ON A VECTORED-THRUST V/STOL FIGHTER IN THE TRANSITION-SPEED RANGE
Raymond E. Mineck and Richard J. Margason Washington Mar. 1974 398 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.
(NASA-TM-X-2867; L-8975) Avail: NTIS HC $8.25 CSCL 01A

A wind-tunnel investigation has been conducted in the Langley V/STOL tunnel with a vectored-thrust V/STOL fighter configuration to obtain detailed pressure measurements on the body and on the wing in the transition-speed range. The vectored-thrust jet exhaust induced a region of negative pressure coefficients on the lower surface of the wing and on the bottom of the fuselage. The location of the jet exhaust relative to the wing was a major factor in determining the extent of the region of negative pressure coefficients. Author

N74-18659# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
A STUDY OF HYPERSONIC BOUNDARY LAYERS OVER A FAMILY OF AXISYMMETRIC BODIES AT ZERO INCIDENCE: PRELIMINARY REPORT AND DATA TABULATION
G. T. Coleman Sep. 1973 37 p refs
(Contract MIN-DEP-AT/2037/057)
(IC-Aero-73-06) Avail: NTIS HC $5.00

A preliminary comparison is made between earlier pressure and heat transfer measurements on a hollow cylinder-flare and hemisphere-cylinder-flare models. All data are tabulated. ESRO

N74-18660# Oxford Univ. (England). Dept. of Engineering Science.
A STUDY OF SPHERE DRAG IN THE TRANSITION FROM CONTINUUM TO FREE MOLECULAR FLOW
K. S Hadjimichalis Oct. 1973 145 p refs
(Contract AT/2057/042)
(Rept-1073/73) Avail: NTIS HC $10.25

An experimental investigation of the effect of wall temperature on the drag of a sphere in the transition from continuum to free molecular flow was conducted. An electromagnetic suspension system was used both to suspend the model and to measure the drag force exerted by the flow. The experiments were conducted in a low density wind tunnel in a flow produced by a freely expanding jet of air. Measurements were obtained for various wall to stagnation temperature ratios, ranging from 0.25 to 1. A stagnation chamber heater was used to heat the gas. The models were cooled by liquid nitrogen in a cooling box before they were introduced to the flow. Author (ESRO)

N74-18661# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
WIND-TUNNEL FORCE MEASUREMENTS ON A 1/20 SCALE MODEL OF BLACK ARROW AT MACH NUMBERS OF 1.2, 1.5 AND 2.0
J. R. Hall London ARC 1973 32 p refs Supersedes RAE-TR-72061; ARC-34019
(ARC-CP-1249; RAE-TR-72061; ARC-34019) Avail: NTIS HC $4.75; HMSO 55p; PHI $2.35

The forces measured on a 1/20 scale model of Black Arrow at Mach numbers of 1.2, 1.5 and 2.0 and at a Reynolds number, based on the maximum body diameter, of 1.31 million are presented. The effects of the external fittings are deduced, and the results are discussed. Author (ESRO)

N74-18662# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
A SUGGESTION FOR IMPROVING FLAP EFFECTIVENESS BY HEAT ADDITION
J. Martin London ARC 1973 53 p refs Supersedes RAE-TR-72002; ARC-33876
(ARC-CP-1252; RAE-TR-72002; ARC-33876) Avail: NTIS HC $5.75; HMSO 85p; PHI $3.55

The effect of heat addition on the flow around a two dimensional flapped airfoil section, at low Mach number, is investigated using a transformation. This enables the compressible flow with heat addition to be deduced from incompressible flow with fluid addition. The incompressible flow may be determined by the technique of conformal mapping. It is concluded that heat addition in a suitable distribution can so reduce the adverse pressure gradient on the upper surface of the flap that greater flap angles than are normally possible can be employed without separation of the boundary layer. The result is an increase in lift. The effect is illustrated for a flapped air-foil section of convenient mathematical form. Author (ESRO)

N74-18663# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
A TECHNIQUE FOR MEASURING OSCILLATORY AERODYNAMIC CONTROL SURFACE HINGE MOMENTS FROM FORCED RESPONSE CHARACTERISTICS
D. R. Gaukroger, D. A. Drane, and R. Gray London ARC 1973 38 p refs Supersedes RAE-TR-71211; ARC-33869
(ARC-CP-1253; RAE-TR-71211; ARC-33869) Avail: NTIS HC $5.00; HMSO 60p; PHI $2.55

A technique for measuring the hinge moment aerodynamic derivatives for an oscillating control surface is described. The technique is identical to that used in the measurement of subcritical response of flutter models, except that the model under test is nominally rigid, and the only designed motion is rotation of the control surface. Test results are given for a full-span control surface on a slightly swept wing. The Mach number range was from M = 0.6 to M = 1.2, and the Reynolds number range from 0.7 to 2.7 million, based on wing mean chord.
Author (ESRO)

N74-18664# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
A THEORETICAL INVESTIGATION OF SUPERSONIC JETS IN SUBSONIC FLOW FIELDS
C. Young London ARC 1973 48 p refs Supersedes RAE-TR-72181; ARC-34318
(ARC-CP-1256; RAE-TR-72181; ARC-34318) Avail: NTIS HC $5.50; HMSO 80p; PHI $3.35

The method of characteristics is used with jet boundary modified by static pressure change produced by the external stream. The method is applied to cases where the inner jet boundary is a solid surface, e.g. the fan exhaust of a bypass engine. Theory and experiment are in close agreement for the range of jet pressure ratios and free stream Mach numbers associated with engines of high bypass ratio. Author (ESRO)

N74-18665# National Physical Lab., Teddington (England). Aerodynamics Div.
NPL 9615 AND NACA 0012: A COMPARISON OF AERODYNAMIC DATA
N. Gregory and P. G. Wilby London ARC 1973 51 p refs Supersedes ARC-30657; NPL-AERO-SR-017
(ARC-CP-1261; ARC-30657; NPL-AERO-SR-017) Avail: NTIS HC $5.75; HMSO 80p; PHI $3.35

Ordinates, surface slopes, and curvatures are listed for the two airfoils together with a detailed tabulation of lift, drag, and pitching moment data obtained at Mach numbers between 0.3 and 0.85 in the NPL 36 in. x 14 in. transonic tunnel. The aerodynamic characteristics and all pressure distribution are plotted, with some comparisons. Author (ESRO)

N74-18666# National Physical Lab., Teddington (England). Aerodynamics Div.
AERODYNAMIC CHARACTERISTICS OF NPL 9626 AND NPL 9627, FURTHER AEROFOILS DESIGNED FOR HELICOPTER ROTOR USE
P. G. Wilby, N. Gregory, and V. G. Quincey London ARC 1973 37 p refs Supersedes ARC-31687; NPL-AERO-SR-036
(ARC-CP-1262; ARC-31687; NPL-AERO-SR-036) Avail: NTIS HC $5.00; HMSO 60p; PHI $2.55

Aerodynamic characteristics and ordinates are given for two modifications to the NACA 0012 profile with leading edge camber that were designed to produce reductions in wave drag in transonic flow. Analyses of hovering helicopter performance are given, to indicate the improvements that would follow from the adoption of either of these airfoils. Author (ESRO)

N74-18667# Admiralty Research Lab., Teddington (England).
BLADE-RATE FORCE FLUCTUATIONS OF A PROPELLER IN NON-UNIFORM FLOW
M. T. Murray and J. Tubby Jun. 1973 56 p refs
(ARL/M/P-33A; BR37674; P2/3.85) Avail: NTIS HC $6.00

When a propeller rotates in a nonuniform flow field, unsteady propeller forces are generated at blade-rate frequency and its harmonics. A method of calculating these forces based upon two-dimensional unsteady aerofoil theory is described. A listing of a FORTRAN program to carry out these calculations is provided, together with a numerical example, and information about using the program. This technique achieves adequate accuracy with minimal computing cost. Author (ESRO)

N74-18668# National Aeronautical Establishment, Ottawa (Ontario).
AN EXPERIMENTAL ANALYSIS AND BUFFET INVESTIGATION OF THE SHOCKLESS LIFTING AIRFOIL NO. 1 [ANALYSE EXPERIMENTALE ET ETUDE DU TREMBLEMENT DU PROFIL PORTEUR NO. 1 SANS CHOC]
J. J. Kacprzynski Aug. 1973 53 p refs
(AD-772727; NAE-LR-569; NRC-13673) Avail: NTIS CSCL 01/1

Results of a second investigation of the shockless lifting airfoil no. 1, performed in the improved NAE high Reynolds number 15 inch x 60 inch two-dimensional test facility, are presented. Better agreement with theoretical design conditions is demonstrated. Off-design characteristics for several Mach numbers are analysed, particularly with regard to maximum lift, buffet and drag divergence. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N74-18669 Cincinnati Univ., Ohio.
INVESTIGATION OF FAR-FIELD AND NEAR-FIELD JET NOISE Ph.D. Thesis
C.-Y. Chen 1973 167 p
Avail: Univ. Microfilms Order No. 74-95167

A method is presented for estimating jet noise in terms of the details of the turbulent field. The acoustic characteristics of a jet are obtained by evaluating contributions from the distribution of sound sources represented as small volume elements of turbulence. Each volume element is regarded as an elementary sound generator emitting acoustic energy at a characteristic frequency. Several models for far- and near-field calculations based on various extensions of Lighthill's quadrupole theory are formulated and evaluated by comparing with experimental data. It is shown that quantitative estimates are obtainable for both the far and near field. The strength distribution of sound sources in a jet obtained in the present calculation is in agreement with the generally accepted theory. It is also shown that an increase of initial turbulence level causes a more pronounced increase of sound at high frequencies than at low frequencies for the far and near field. Dissert. Abstr.

N74-18670*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 38, DECEMBER 1973
Dec. 1973 147 p refs
(NASA-SP-7037(38)) Avail: NTIS HC $4.00 CSCL 01B

This special bibliography lists 473 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1973. Author

N74-18671*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
INITIAL RESULTS FROM FLIGHT TESTING A LARGE, REMOTELY PILOTED AIRPLANE MODEL
Euclid C. Holleman, comp. Mar. 1974 42 p refs
(NASA-TM-X-56024) Avail: NTIS HC $5.25 CSCL 01C

The first four flights of a remotely piloted airplane model showed that a flight envelope can be expanded rapidly and that hazardous flight tests can be conducted safely with good results. The flights also showed that aerodynamic data can be obtained quickly and effectively over a wide range of flight conditions, clear and useful impressions of handling and controllability of configurations can be obtained, and present computer and electronic technology provide the capability to close flight control loops on the ground, thus providing a new method of design and flight test for advanced aircraft. Author

N74-18672*# General Electric Co., Evendale, Ohio. Aircraft Engine Group.
IMPACT RESISTANCE OF CURRENT DESIGN COMPOSITE FAN BLADES TESTED UNDER SHORT-HAUL OPERATING CONDITIONS Interim Report, Jul. 1972 - Jun. 1973
C. A. Steinhagen and C. T. Salemme Jul. 1973 60 p
(Contract NAS3-16777)
(NASA-CR-134533; R74AEG219) Avail: NTIS HC $6.00 CSCL 01C

Boron/epoxy and graphite/epoxy composite blades were impacted in a rotating whirligig facility with conditions closely simulating those which might be experienced by a STOL engine impacted with various foreign objects. The tip speed of the rotating blades was 800 feet per second. The blades were impacted with simulated birds, real birds, ice balls, and gravel. The results of composite blade impact tests were compared with a titanium blade tested under similar conditions. Neither composite material indicated a clear superiority over the other. Blades made from both composite materials showed more damage than the titanium blades. Author

N74-18673*# Boeing Co., Seattle, Wash.
CRUISE DRAG RESULTS FROM HIGH SPEED WIND TUNNEL TESTS OF NASA REFAN JT8D ENGINE NACELLES ON THE BOEING 727-200
W. G. Easterbrook and R. B. Carlson Dec. 1973 42 p
(Contract NAS3-17842)
(NASA-CR-134546; D6-43099) Avail: NTIS HC $5.25 CSCL 01C

High speed wind tunnel test results are presented showing the cruise drag effect of installing JT8D-109 Refan engines on a Boeing 727-200. Incremental drags of a refan center inlet and side nacelles are presented for several configuration variations. Static pressure distributions were obtained on the side nacelle strut and on the fuselage (above and below the strut). Oil flow photographs of selected configurations are also presented. In general the drag level of the refan installation is slightly better than predicted prior to the test and the drag rise is favorable. Author

N74-18674*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
ANALYTICAL STUDY TO DEFINE A HELICOPTER STABILITY DERIVATIVE EXTRACTION METHOD, VOLUME 1 Final Report
John A. Molusis May 1973 244 p refs
(Contract NAS1-11613)
(NASA-CR-132371) Avail: NTIS HC $15.25 CSCL 01B

A method is developed for extracting six degree-of-freedom stability and control derivatives from helicopter flight data. Different combinations of filtering and derivative estimate are investigated and used with a Bayesian approach for derivative identification. The combination of filtering and estimate found to yield the most accurate time response match to flight test data is determined and applied to CH-53A and CH-54B flight data. The method found to be most accurate consists of (1) filtering flight test data with a digital filter, followed by an extended Kalman filter (2) identifying a derivative estimate with a least square estimator, and (3) obtaining derivatives with the Bayesian derivative extraction method. Author

N74-18675*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
ANALYTICAL STUDY TO DEFINE A HELICOPER STABILITY DERIVATIVE EXTRACTION METHOD, VOLUME 2 Final Report
John A. Molusis May 1973 216 p
(Contract NAS1-11613)
(NASA-CR-132372) Avail: NTIS HC $14.00 CSCL 01B

The data generated during tests to determine helicopter stability derivatives are presented in the form of graphs. The data are based on CH-53A helicopters and CH-54B helicopters with various digital filters operating at various airspeeds. Curves are plotted for a time history comparison of identified derivative models against flight data for the helicopters at specific airspeeds and maneuvers. P.N.F.

N74-18676*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONTROL THEORY ANALYSIS OF A THREE-AXIS VTOL FLIGHT DIRECTOR M.S. Thesis - Pennsylvania State Univ.
Frank R. Niessen Jun. 1971 85 p refs
(NASA-TM-X-69960) Avail: NTIS HC $7.25 CSCL 01C

A control theory analysis of a VTOL flight director and the results of a fixed-based simulator evaluation of the flight-director commands are discussed. The VTOL configuration selected for this study is a helicopter-type VTOL which controls the direction of the thrust vector by means of vehicle-attitude changes and, furthermore, employs high-gain attitude stabilization. This configuration is the same as one which was simulated in actual instrument flight tests with a variable stability helicopter. Stability analyses are made for each of the flight-director commands, assuming a single input-output, multi-loop system model for each control axis. The analyses proceed from the inner-loops to the outer-loops, using an analytical pilot model selected on the basis of the innermost-loop dynamics. The time response of the analytical model of the system is primarily used to adjust system gains, while root locus plots are used to identify dominant modes and mode interactions. Author

N74-18677*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRELIMINARY PERFORMANCE ESTIMATES OF A HIGHLY MANEUVERABLE REMOTELY PILOTED VEHICLE
Walter P. Nelms, Jr. and John A. Axelson Washington Feb. 1974 102 p refs
(NASA-TN-D-7551; A-5157) Avail: NTIS HC $4.50 CSCL 01C

A computerized synthesis program has been used to assess the effects of various vehicle and mission parameters on the performance of a highly maneuverable remotely piloted vehicle (RPV) for the air-to-air combat role. The configuration used in the study is a trapezoidal-wing and body concept, with forward-mounted stabilizing and control surfaces. The study mission consists of an outbound cruise, an acceleration phase, a series of subsonic and supersonic turns, and a return cruise. Performance is evaluated in terms of both the required vehicle weight to accomplish this mission and combat effectiveness as measured by turning and acceleration capability. The report describes the synthesis program, the mission, the vehicle, and the results of sensitivity and trade studies. Author

N74-18678*# Boeing Vertol Co., Philadelphia, Pa.
ACOUSTICAL PROPERTIES OF A MODEL ROTOR IN NONAXIAL FLIGHT Final Report
E. Hinterkeuser 15 Sep. 1973 66 p refs Sponsored in part by Army Air Mobility R and D Lab., Moffett Field, Calif.
(Contract NAS2-5473)
(NASA-CR-114749; D210-10666-2) Avail: NTIS HC $6.50

CSCL 01C

Wind tunnel measurements on model rotor blade loads and acoustical noise were correlated to a theoretical formulation of the rotational noise of a rotor in non-axial flight. Good correlation between theory and data was achieved using actual measured rotor blade pressure harmonic decay levels and lift, drag and radial force magnitudes. Both pressure and acoustic data exhibited considerable scatter in hover and low speed forward flight which resulted in a fairly wide latitude in the noise level prediction at higher harmonics. Author

N74-18679*# Lockheed-Georgia Co., Marietta.
CORREALTION OF FULL-SCALE DRAG PREDICTIONS WITH FLIGHT MEASUREMENTS ON THE C-141A AIRCRAFT. PHASE 2: WIND TUNNEL TEST, ANALYSIS, AND PREDICTION TECHNIQUES. VOLUME 1: DRAG PREDICTIONS, WIND TUNNEL DATA ANALYSIS AND CORRELATION Final Report
D. G. MacWilkinson, W. T. Blackerby, and J. H. Paterson Washington NASA Feb. 1974 166 p refs
(Contract NAS1-10045)
(NASA-CR-2333; LG73ER0058-Vol-1) Avail: NTIS HC $5.00 CSCL 01C

The degree of cruise drag correlation on the C-141A aircraft is determined between predictions based on wind tunnel test data, and flight test results. An analysis of wind tunnel tests on a 0.0275 scale model at Reynolds number up to 3.05 x 1 million/MAC is reported. Model support interference corrections are evaluated through a series of tests, and fully corrected model data are analyzed to provide details on model component interference factors. It is shown that predicted minimum profile drag for the complete configuration agrees within 0.75% of flight test data, using a wind tunnel extrapolation method based on flat plate skin friction and component shape factors. An alternative method of extrapolation, based on computed profile drag from a subsonic viscous theory, results in a prediction four percent lower than flight test data. Author

N74-18680*# Lockheed-Georgia Co., Marietta.
CORRELATION OF FULL-SCALE DRAG PREDICTIONS WITH FLIGHT MEASUREMENTS ON THE C-141A AIRCRAFT : PHASE 2: WIND TUNNEL TESTS, ANALYSIS, AND PREDICTION TECHNIQUES. VOLUME 2: WIND TUNNEL TEST AND BASIC DATA Final Report
D. G. MacWilkinson, W. T. Blackerby, and J. H. Paterson Washington NASA Feb. 1974 187 p refs
(Contract NAS1-10045)
(NASA-CR-2334; LG73ER0058-Vol-2) Avail: NTIS HC $5.50 CSCL 01C

A research program has been conducted to determine the degree of cruise drag correlation on the C-141A aircraft between predictions based on wind tunnel test data, and flight test results. Information is presented on the wind tunnel test program and basic aerodynamic data on the C-141A wind-tunnel model used in the correlation studies. Author

N74-18681*# Rockwell International Corp., Downey, Calif. Space Div.
A METHODOLOGY FOR BOOST-GLIDE TRANSPORT TECHNOLOGY PLANNING Final Report
E. M. Repic, G. A. Olson, and R. J. Milliken Washington NASA Feb. 1974 274 p ref
(Contract NAS1-6024)
(NASA-CR-2346; SD-73-SA-0064) Avail: NTIS HC $6.50 CSCL 01C

A systematic procedure is presented by which the relative economic value of technology factors affecting design, configuration, and operation of boost-glide transport can be evaluated. Use of the methodology results in identification of first-order economic gains potentially achievable by projected advances in each of the definable, hypersonic technologies. Starting with a baseline vehicle, the formulas, procedures and forms which are integral parts of this methodology are developed. A demonstration of the methodology is presented for one specific boost-glide system. Author

N74-18682# Advisory Group for Aerospace Research and Development, Paris (France).
AN OVERVIEW OF US ARMY HELICOPTER STRUCTURES RELIABILITY AND MAINTAINABILITY
Thomas L. House (Army Air Mobility R and D Lab., Fort Eustis, Va.) Jan. 1974 19 p refs Presented at 36th Meeting of the Structures and Mater. Panel (SMP), Milan, 2-6 Apr. 1973
(AGARD-R-613) Avail: NTIS HC $4.00

Approximately 25 percent of all U. S. Army helicopter failures and field maintenance man hours are related to structures. Externally induced damage is the primary cause of many failures, and it is the essential reliability and maintainability consideration in the selection of rotor blade and transparency designs. With the exception of rotor blades, most structural failures are normally considered as maintenance downtime sensitive as opposed to a cost problem. Greatly improved design and test documents coupled with lessons learned appear to be the most responsive approach to gaining significant structural improvements. Helicopter vibration reduction can produce a major reduction in secondary structural failure and maintenance rates. Author

N74-18683# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORT: LOFTLEIDIR ICELANDIC AIRLINES, INCORPORATED, DOUGLAS DC-8-61, JOHN F. KENNEDY INTERNATIONAL AIRPORT, JAMAICA, NEW YORK, 23 JUNE 1973
5 Dec. 1973 32 p
(NTSB-AAR-73-20) Avail: NTIS HC $4.75

On June 23, 1973, a scheduled passenger and cargo flight, was involved in a landing accident after an instrument landing approach to runway 31R at the John F. Kennedy International Airport, Jamaica, New York. Of the 119 passengers and 9 crewmembers aboard the flight, 6 passengers and 2 stewardesses were injured seriously; there were no fatalities. The aircraft was damaged substantially. When the aircraft was about 40 feet above the runway, the ground spoilers were inadvertently deployed. The aircraft descended rapidly and hit the ground, tailfirst, 20 feet short of the displaced runway threshold. The probable cause of the accident was the first officer's inadvertent deployment of the ground spoilers in flight while he was attempting to arm the spoiler system. The captain's decision to delay arming of the spoilers until just before touchdown was a contributing factor, because the timing varied from normal procedures and required the crewmembers to act quickly, without time for corrective action. Author

N74-18684# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORT: SKYWAYS INTERNATIONAL, INCORPORATED, DOUGLAS DC-7C, N296 NEAR THE MIAMI INTERNATIONAL AIRPORT, DADE COUNTY, FLORIDA, 21 JUNE 1973
27 Feb. 1974 28 p refs
(NTSB-AAR-74-2) Avail: NTIS HC $4.50

A Douglas DC-7C crashed into the Everglades, 8.9 nautical miles north west of the Miami International Airport, on June 21, 1973. The accident occurred at 0426 e.d.t., about 6 minutes after the aircraft took off from runway 27L on the Miami International Airport. Before the aircraft crashed, fire damaged the lift wing and the No. 1 engine. The aircraft was destroyed on impact. Three crewmembers, the only persons on board, were killed. The accident occurred during the hours of darkness and extremely heavy rain, wind, and lightning. There were no eyewitnesses. The probable cause of the accident was the loss of aircraft control, due either to turbulence or an in-flight fire, or both. Inability of the crew to establish timely radio communications with the departure controller was also a factor, because it delayed compliance with thunderstorm avoidance vectors. Author

N74-18685*# Hydrospace-Challenger, Inc., San Diego, Calif.
NOISE MEASUREMENTS AT STOCKTON AIRPORT OBTAINED DURING ENGINEERING EVALUATION OF TWO-SEGMENT APPROACHES IN A 727-222 AIRCRAFT
Ray E. Glass and Carole S. Tanner 31 Aug 1973 22 p
(Contract NAS2-7369)
(NASA-CR-114689) Avail: NTIS HC $4.25 CSCL 20A

The results of acoustic measurements made on a 727-222 aircraft during standard ILS and two-segment approaches are

presented. The aircraft was equipped with a special purpose glide slope computer to provide the capability of making two-segment noise abatement approaches. For upper segment computations, the computer used barometric-corrected pressure altitude and the slant range to a DME transmitter which was colocated with the glide slope transmitter. The computer used the ILS glide slope deviation for lower segment computations. Additional measurements were made on 737 revenue aircraft using the Stockton Airport. The purpose of the acoustical portion of the test was to measure and identify the noise levels during the various approaches. Author

N74-18686*# Hydrospace-Challenger, Inc., San Diego, Calif.
NOISE MEASUREMENTS TAKEN AT LAX DURING OPERATIONAL EVALUATION OF TWO-SEGMENT APPROACHES IN A 727-200 AIRCRAFT
Carole S. Tanner and Ray E. Glass 31 Aug. 1973 21 p
(Contract NAS2-7369)
(NASA-CR-114690; HCI-TR-S-231) Avail: NTIS HC $4.25 CSCL 20A

A series of seven noise measurements were made each day over a period of fifteen days. The first and last flights each day were made by a specially instrumented 727-200 aircraft being used to evaluate the operational effectiveness of two-segment noise abatement approaches in scheduled service. Noise measurements were made to determine the noise reduction benefits of the two-segment approaches. Author

N74-18687# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.
SEPARATE SURFACE STABILITY AUGMENTATION DESIGN AND DEVELOPMENT Status Report
D. J. Collins Nov. 1973 95 p refs
Avail: NTIS HC $7.75

An approach to the mechanization of an attitude command control system for aircraft control is presented. The approach consisted of using control surfaces separate from the primary pilot's control surfaces. The anticipated advantages of the system are described. The design and development of the system are reported. The simulation and flight testing of the system are explained. Author

N74-18688*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT INVESTIGATION OF EFFECTS OF A FAN-IN-FIN YAW CONTROL CONCEPT ON HELICOPTER FLYING-QUALITY CHARACTERISTICS
Henry L. Kelley and Thomas C. West Washington Apr. 1974 30 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.
(NASA-TN-D-7452; L8923) Avail: NTIS HC $3.25 CSCL 01C

Flight-test results which describe flying-quality factors related to the fan-in-fin yaw control concept as utilized on a pre-production version of a European helicopter are presented. Design compromises to be considered with this concept are also presented. The large, fixed vertical fin associated with the fan-in-fin system was helpful in maneuvering flight, but introduced several flying-quality problems when combined with the fan. Author

N74-18689# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
GUST LOADS ON COMET AIRCRAFT
I. W. Kaynes London ARC 1973 64 p refs Supersedes RAE-TR-71165; ARC-33682
(ARC-CP-1247; RAE-TR-71165; ARC-33682) Avail: NTIS HC $6.25; HMSO 85p; PHI $3.55

Counting accelerometers have been used to record normal acceleration on BOAC Comet 4 and RAF Comet 4C aircraft for flight distances of 910,000 km and 388,000 km respectively. Two Comet 4 aircraft carried instruments and a significant difference is found between the frequencies of gusts observed on each. Revised data for the BOAC Comet 1 and RAF Comet 2 are presented and comparison of the four fleets shows that loads were recorded more often on the civil airline operations. The effect of the cloud warning radar carried by only the later aircraft is studied. Author (ESRO)

N74-18690# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
SOME OBSERVATIONS ON MANOEUVRE STABILITY AND LONGITUDINAL CONTROL
W. J. Pinsker London ARC 1973 22 p refs Supersedes RAE-TR-72068; ARC-34020
(ARC-R/M-373C; RAE-TR-72068; ARC-34020) Avail: NTIS HC $4.25; HMSO 85p; PHI $3.55

Some of the more important practical implications to pilot's control, flight test analysis, and stability augmentor performance of classical lontitudinal stability theory are discussed. The distinction between turns and pull-ups is reemphasized and the differences quantified. Angular momentum of the engines is shown to make a contribution which can be significant with STOL aircraft, being destabilizing in turns in one direction but stabilizing in the opposite direction. Author (ESRO)

N74-18691# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
A CONCEPTUAL DEFINITION STUDY FOR A DIGITAL AVIONICS INFORMATION SYSTEM: APPROACH 1, VOLUME 1 Final Report, Feb. - Jul. 1973
William C. Booton, Dan H. Daggett, H. O. Gaffin, C. D. Campbell, W. B. Anderson, H. W. Blackmon, L. C. Klos, J. P. Catching, W. J. Yousey, and G. E. Hinds Wright-Patterson AFB, Ohio AFAL Oct. 1973 49 p 3 Vol.
(Contract F33615-73-C-1244)
(AD-771736; AFAL-TR-73-300-Vol-1) Avail: NTIS CSCL 01/3

The report contains the results of a study to conceptually define the Digital Avionics Information System (DAIS). A predesign analysis provided the Air Force with sufficient information to define the best design approach for the development of the four DAIS core elements. Core elements are identified as (1) a microprogrammable processor system, (2) a multiplex/interface system, (3) a modular software system, and (4) an integrated control and display system. In addition, the requirements for a digital flight control system were identified; and associated DAIS processing, control and display, and distribution requirements necessary for function implementation were determined. (Modified author abstract) GRA

N74-18692# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
A CONCEPTUAL DEFINITION STUDY FOR A DIGITAL AVIONICS INFORMATION SYSTEM: APPROACH 1, VOLUME 2 Final Report, Feb. - Jul. 1973
William C. Booton, Dan H. Daggett, H. O. Gaffin, C. D. Campbell, W. B. Anderson, H. W. Blackmon, L. C. Klos, J. P. Catching, W. J. Yousey, and G. E. Hinds Wright-Patterson AFB, Ohio AFAL Oct. 1973 332 p refs 3 Vol.
(Contract F33615-73-C-1244)
(AD-771755; AFAL-TR-73-300-Vol-2) Avail: NTIS CSCL 01/3

Contents: Functional requirements; Breakpoints and partitioning; Information management requirements. GRA

N74-18693# Lockheed-California Co., Burbank.
ICE PROTECTION INVESTIGATION FOR ADVANCED ROTARY-WING AIRCRAFT Final Report
J. B. Werner Aug. 1973 392 p refs
(Contract DAAJ02-72-C-0054)
(AD-771182/3GA; LR-25327-10; USAAMRDL-TR-73-38) Avail: NTIS HC $8.00 CSCL 01/3

Ice protection requirements for advanced rotary wing aircraft were studied. The study included investigations into the hazards of flying through ice, probability of icing, vehicle ice accretion rates, current ice protection system designs, operational limitations of current helicopters, and advanced deicing concepts. (Modified author abstract) GRA

N74-18694# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
FIRE AND EXPLOSION MANUAL FOR AIRCRAFT ACCIDENT INVESTIGATORS Final Summary Report, 1 Jul. 1972 - 31 Jul. 1973
Joseph M. Kuchta Aug. 1973 136 p refs
(Contract F33615-72-M-5008)

(AD-771191/4GA; PMSRC-4:93; AFAPL-TR-73-74) Avail: NTIS HC $4.50 CSCL 01/2

The manual was prepared at the request of the Air Force to provide aircraft accident investigators with compilations of various safety data and with suitable guidlines for investigating aircraft fires or explosions. Sections are included on investigative procedures, physical properties of materials, ignitability and flammability characteristics of flammable fluids or solids, damage analysis of fires or explosions, and the evaluation of protective measures. Compilations of selected data for fuels, lubricants, hydraulic fluids, explosives, and other materials of interest are given in the appendix for quick reference. Definitions and theory necessary to the application of these data are included in the appropriate sections of the manual. (Modified author abstract) GRA

N74-18695# Army Aviation Systems Command, St. Louis, Mo.

MAJOR ITEM SPECIAL STUDY (MISS), AH-1G MAIN TRANSMISSION ASSY, UNIVERSAL Interim Report, Jan. 1964 - Jul. 1972

Dec. 1973 32 p

(AD-772983; USAAVSCOM-TR-73-30) Avail: NTIS CSCL 01/3

Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items selected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distributions can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas. Author (GRA)

N74-18696# Boeing Vertol Co., Philadelphia, Pa.

STUDY OF ADVANCED STRUCTURAL CONCEPTS FOR FUSELAGE Final Technical Report

Sidney C. Swatton Oct. 1973 189 p refs

(Contract DAAJ02-72-C-0056; DA Proj. 1F1-62208-A-170)

(AD-772708; D210-10683; USAAMRDL-TR-73-69) Avail: NTIS CSCL 01/3

The report presents the results of a study conducted to develop advanced structural concepts and the application of fiber-reinforced composite materials for the Cobra AH-1G helicopter tail section. This study comprised the following tasks: (1) analysis of existing AH-1G metal tail section to determine areas having highest potential structural improvement, (2) development and preliminary design studies of various advanced structural concepts and selection of three concepts for preliminary design trade-off study, (3) determination of parameters affecting cost effectiveness and performance of composite fuselage structure, (4) sensitivity analysis for reducing tail-section life-cycle costs, and (5) development of a math model for life-cycle costs and performance of composite fuselage, and utilization of model to recommend the optimum design. (Modified author abstract) GRA

N74-18697# Rockwell International Corp., Los Angeles Calif. Aircraft Div.

STOL TACTICAL AIRCRAFT INVESTIGATION: EXTERNALLY BLOWN FLAP. VOLUME 1: CONFIGURATION DEFINITION Final Report, 10 Jun. 1971 - 10 Dec. 1972

Herschel G. Owens, Roy S. Kaneshiro, Dirk J. Renselaer, and Don W. Schlundt Apr. 1973 371 p refs

(Contract F33615-71-C-1760; AF Proj. 643A)

(AD-772738; AFFDL-TR-73-20-Vol-1) Avail: NTIS CSCL 01/1

The basic objective of the report is to provide a broader technology base to support the development of a medium STOL Transport (MST) airplane. The work is limited to the application of the externally blown flap (EBF) powered lift concept. The technology of EBF STOL aircraft is investigated through analytical studies, wind tunnel testing, flight simulator testing, and design trade studies. The results obtained include development of methods for the estimation of the aerodynamic characteristics of an EBF configuration, STOL performance estimation methods, safety margins for takeoff and landing, wind tunnel investigation of the effects of varying EBF system geometry parameters, configuration definition to meet MST requirements, trade data on performance and configuration requirement variations, flight control system mechanization trade data, handling qualities characteristics, piloting procedures, and effects of applying an air cushion landing system to the MST. (Modified author abstract) GRA

N74-18698# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

A LIMITED ANALYSIS OF AN F-4C AIRCRAFT WITH A HIGH-GAIN CONTROL AUGMENTATION SYSTEM AND COMPARISON WITH FLIGHT TEST DATA

Richard A. Kogler May 1973 118 p refs

(AD-772673; ASD-TR-73-21) Avail: NTIS CSCL 01/3

A high-gain control augmentation system was designed by the Bendix Corporation to allow the pilot of a fighter aircraft to command the C^* parameter through the longitudinal control stick. This system was installed in an F-4C aircraft and flight tested at the Air Force Flight Test Center. A theoretical analysis of the control augmentation system and airframe combination was performed for nine selected flight conditions. The results showed that the CAL thumbprint, MIL-F-8785 B(ASG) and C^* flying qualities criteria do not predict longitudinal flying qualities consistent with qualitative pilot ratings from flight test. Pilot comments indicated significant improvement in the longitudinal flying qualities of the F-4C with the C^* command control augmentation system over the production aircraft. (Modified author abstract) GRA

N74-18699# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TO ASSIST THE SPORTSMAN-HELICOPTER PILOT IN BLIND FLIGHT

F. Prokopenko 11 Dec. 1973 17 p Transl. into ENGLISH from Krylya Rodiny (USSR), no. 3, Mar. 1969 p 23-25

(AD-772650; FTD-HT-23-481-74) Avail: NTIS CSCL 01/2

The report proposes recommendations for mastering instrument flight in helicopters. GRA

N74-18700# Boeing Vertol Co., Philadelphia, Pa.

CH-47A DESIGN AND OPERATIONAL FLIGHT LOADS STUDY Final Report

A. Herskovitz and H. Steinmann Nov. 1973 52 p refs

(Contract DAAJ02-72-C-0087; DA Proj. 1F1-62204-AA-82)

(AD-772949; D210-10579-1; USAAMRDL-TR-73-40) Avail: NTIS CSCL 01/3

The report describes a study made to evaluate the adequacy of current structural design criteria for future cargo- and transport-type helicopters based on the design, development, and operational use of the CH47A Chinook helicopter. It was concluded that current structural design criteria are adequate to insure structural safety. Specifications for procurement of new helicopters should be modified to provide the most realistic mission description possible for fatigue design, with the objective of simplifying the design task. While analyzing CH-47A operational data, several deficiencies were identified in the data acquisition and analysis process. (Modified author abstract) GRA

N74-18701# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.

A PROGRAM FOR COMPUTING THE PRESSURE DISTRIBUTION AND AERODYNAMIC COEFFICIENTS FOR CAMBERED THIN SUPERSONIC WINGS OF ARBITRARY PLANFORM WITH SUBSONIC LEADING EDGES

Bruce L. VanBuren 5 Aug. 1973 70 p refs

(DA Proj. 1M2-62303-A-214)

(AD-772952; RD-73-24) Avail: NTIS CSCL 01/1

The computer solution to the linearized potential flow equations which gives a reasonably accurate description of the pressure distribution for thin cambered supersonic wings with subsonic leading edges is presented. The program will compute the aerodynamic coefficients associated with the pressure

distribution such that comparison can be made of the aerodynamic characteristics between a flat wing and a cambered wing at small angles of attack. Author (GRA)

N74-18702# Army Aeromedical Research Lab., Fort Rucker, Ala.
PARACHUTE ESCAPE FROM HELICOPTERS
William P. Chane Aug. 1973 14 p refs
(DA Proj. 3A0-62110-A-819)
(AD-772970; USAARL-74-4) Avail: NTIS CSCL 01/2

Experimental evidence shows that a parachutist experiences no major difficulty in achieving vertical and horizontal separation from an autorotating helicopter. At high rates of descent, there is a 0.5 - 0.75 second delay after exit before expected separation begins. Author (GRA)

N74-18703# Delaware Univ., Newark.
OPEN AND CLOSED LOOP STABILITY OF HINGELESS ROTOR HELICOPTER AIR AND GROUND RESONANCE
Maurice I. Young, David J. Bailey, and Murray S. Hirschbein 1974 34 p refs
(Grant DA-ARO(D)-31-124-71-G112)
(AD-772826; AROD-9549-9-E) Avail: NTIS CSCL 01/3

The air and ground resonance instabilities of hingeless rotor helicopters are examined on a relatively broad parametric basis including the effects of blade tuning, virtual hinge locations, and blade hysteresis damping, as well as size and scale effects in the gross weight range from 5,000 to 48,000 pounds. A special case of a 72,000 pound helicopter air resonance instability is also included. (Modified author abstract) GRA

N74-18704# Rockwell International Corp., Los Angeles Calif. Aircraft Div.
STOL TACTICAL AIRCRAFT INVESTIGATION-EXTERNALLY BLOWN FLAP. VOLUME 4: ANALYSIS OF WIND TUNNEL DATA Final Report, 10 Jun. 1971 - 10 Dec. 1972
Patrick P. Papp, Ralph A. Quam, and Gerald A. Freeman Apr. 1973 395 p refs
(Contract F33615-71-C-1760; AF Proj. 643A)
(AD-772774; AFFDL-TR-73-20-Vol-4) Avail: NTIS CSCL 01/1

The basic objective of the report is to provide a broader technology base to support the development of a medium STOL Transport (MST) airplane. The work is limited to the application of the externally blown flap (EBF) powered lift concept. From an overall assessment of study results, it is concluded that the EBF concept provides a practical means of obtaining STOL performance for an MST with relatively low risk. (Modified author abstract) GRA

N74-18705# Rochester Univ., N.Y.
ANALYTICAL INVESTIGATION OF THE AERODYNAMIC STABILITY OF HELICAL VORTICES SHED FROM A HOVERING ROTOR Final Report
Bharat P. Gupta and Robert G. Loewy Oct. 1973 150 p refs
(Contract DAAJ02-72-C-0042; DA Proj. 1F1-62204-AA-42)
(AD-773026; USAAMRDL-TR-73-84) Avail: NTIS CSCL 01/1

A small-perturbation stability analysis of a doubly infinite array of interdigitated, right circular helical vortices has been formulated. This array corresponds to the vortices trailed from the tips of the blades of a helicopter rotor or propeller in static thrust or axial flight condition and at great distance from the plane of rotation of the blades. The analysis makes use of the Biot-Savart law of induction and the Vorticity Transport Theorem. The singularities in the Biot-Savart integration for self-induction have been eliminated by substituting approximate functions. Near-singular behavior in other integrals has been minimized by adding and subtracting functions with similar near-singular behavior and which have exact, closed-form integrals. (Modified author abstract) GRA

N74-18706# AiResearch Mfg. Co., Los Angeles, Calif.
ADVANCED TORQUE MEASUREMENT SYSTEM Final Technical Report
J.-D. Chang and Joseph Kukel Aug. 1973 205 p refs
(Contract DAAJ02-72-C-0044; DA Proj. 1F1-62205-A-119)
(AD-773021; USAAMRDL-TR-73-54; Rept-73-9343) Avail: NTIS CSCL 01/3

The report encompasses the preliminary research of application requirements, error sources, and special considerations; design of the advanced torque measurement system; fabrication of the advanced torque measurement system; and laboratory testing of the advanced torque measurement system under various conditions. Program results indicate that such a high-accuracy and high-environmental-tolerance torque measurement system for helicopter power-plant diagnostic purpose is both hardware implementable and economically feasible. (Modified author abstract) GRA

N74-18707# Boeing Vertol Co., Philadelphia, Pa.
ANALYSIS OF CRITERIA FOR ON-CONDITION MAINTENANCE FOR HELICOPTER TRANSMISSIONS Final Report
J. J. Dougherty, III and S. J. Blewitt Sep. 1973 379 p refs
(Contract DAAJ02-72-C-0068; DA Proj. 1F1-62205-A-119)
(AD-773024; D210-10593-1; USAAMRDL-TR-73-58) Avail: NTIS CSCL 01/3

The report presents the results of a study which develops a rational approach for evaluating the potential of a helicopter transmission for on-condition operation. Integral to this study is the presentation of the mathematical relationship between component operating time and component hazard rate. It is postulated that the component hazard function is the crux of an on-condition analysis. Various methods of determining hazard functions were evaluated, and a conclusion is presented defining the most powerful of these techniques. An evaluation of the impact of on-condition transmission operation upon reliability, safety, availability, maintainability, mission reliability, and cost was developed. The conclusions of the study present the criteria for evaluating the potential of a newly designed or existing helicopter transmission for on-condition operation. (Modified author abstract) GRA

N74-18708# Boeing Vertol Co., Philadelphia, Pa.
DESIGN, FABRICATION, AND FLIGHT TEST OF THE ACTIVE ARM EXTERNAL LOAD STABILIZATION SYSTEM FOR CARGO HANDLING HELICOPTERS Final Technical Report
J. H. Smith, G. M. Allen, and D. Vensel Sep. 1973 173 p refs
(Contract DAAJ02-72-C-0046; DA Proj. 1F1-63209-DB-33)
(AD-773025; D210-10638-1; USAAMRDL-TR-73-73) Avail: NTIS CSCL 01/3

The report discusses the analysis, design, fabrication, and flight test of an experimental active arm external load stabilization system. The purpose of this effort was to achieve the load damping required for helicopter instrument flight rules operations (load modal damping ratio greater than 0.25) without imposing excessive power requirements on the helicopter subsystems or unsafe conditions on the helicopter. Flight test of the system on the Boeing Model 347 helicopter demonstrated adequate load dynamic stability characteristics and elimination of pilot-induced oscillation throughout the test flight envelope. (Modified author abstract) GRA

N74-18709# Systems Associates, Inc., Long Beach, Calif.
US ARMY HELICOPTER HYDRAULIC SYSTEM RELIABILITY AND MAINTAINABILITY INVESTIGATION. VOLUME 1: DOCUMENT DEFICIENCY ANALYSIS Final Report
James L. Huffman Sep. 1973 228 p refs 2 Vol.
(Contract DAAJ02-73-C-0013; DA Proj. 1F1-62205-A-119)
(AD-773022; SAI-R73-005-Vol-1;
USAAMRDL-TR-73-63A-Vol-1) Avail: NTIS CSCL 13/7

The investigation was performed in order to identify deficiencies in military specifications and standards concerning hydraulic systems in U.S. Army helicopters. The three areas of concern that impact on helicopter reliability and maintainability are: design requirements, qualification test requirements, procedures and practices, and quality assurance provisions and requirements. Documents were collected from DOD sources, supplemented by information from manufacturers: drawings, and Army maintenance manuals. They were analyzed for application to the documentation tree and whether they required major revision, minor revision, deletion, or rewrite. Areas which lacked design documentation were identified for new documentation requirements. (Modified author abstract) GRA

N74-18710# Systems Associates, Inc., Long Beach, Calif.
US ARMY HELICOPTER HYDRAULIC SYSTEM RELIABILITY AND MAINTAINABILITY INVESTIGATION. VOLUME 2: SUPPLEMENTAL DESIGN GUIDE Final Report
James L. Huffman Sep. 1973 209 p refs 2 Vol.
(Contract DAAJ02-73-C-0013; DA Proj. 1F1-62205-A-119)
(AD-773023; SAI-R73-005-Vol-2; USAAMRDL-TR-73-63B-Vol-2) Avail: NTIS CSCL 13/7

The report is a result of the investigation performed in Volume 1, Document Deficiency Analysis which identifies deficiencies in military specifications and standards that may impact the reliability and maintainability of U.S. Army helicopters. The report provides supplementary information for each deficient document relating to design requirements, qualification testing, and quality assurance. The supplementary information to offset the most prevalent deficiencies addressed helicopter mission design requirements which relate to environmental conditions, reliability and maintainability programs, and safety. Environmental testing and reliability and maintainability requirements were also addressed. (Modified author abstract) GRA

N74-18711# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
CH-53 A FLEXIBLE FRAME VIBRATION ANALYSIS/TEST CORRELATION
Irwin J. Keningsberg 28 Mar. 1973 248 p
(Contract N00019-72-C-0411)
(AD-772569; SER-651195) Avail: NTIS CSCL 01/3

The Sikorsky Finite Element Airframe Vibration Analysis (Fran/Vibration Analysis) has been found to correlate well with data taken in shake tests of the CH-53A. The frequencies of fundamental fuselage bending and transmission modes were predicted by the Fran/Vibration Analyses to an average accuracy of three percent. In addition, the mode shapes were defined accurately. The modeling techniques and analysis used in the study can be applied during helicopter design and during evaluation of growth versions of current aircraft. These techniques, in combination with an accurate definition of the vehicle's structural characteristics, will enable accurate prediction of all transmission and fuselage modes for a vehicle without a cargo ramp. (Modified author abstract) GRA

N74-18712# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
CH-54 B MAIN GEARBOX THERMAL MAPPING PROGRAM Final Report
Donald F. Wilson Nov. 1973 106 p refs
(Contract DAAJ02-72-C-0072; DA Proj. 1G1-62208-AA-72)
(AD-772664; SER-64375; USAAMRDL-TR-73-79) Avail: NTIS CSCL 01/3

The report contains the procedures and results of a thermal mapping program conducted on the CH-54B main gearbox. The gearbox was analyzed to determine heat paths and heat sources and was instrumented to measure housing and dynamic component temperatures as well as thermal growth. Thermal maps of the gearbox were made at oil-outlet temperatures of 242F, 280F, 325F, and 372F. MIL-L-7808G oil was used for all tests. The temperatures measured indicated that the present method of analyzing the gearbox is adequate. Thermal growth measurements indicated that the handbook values for thermal coefficient of expansion are adequate for analysis. Recommendations are made for additional research required to develop a self-contained, more survivable gearbox design. Author (GRA)

N74-18713# Fiber Science, Inc., Gardena, Calif.
UH-1D FILAMENT-WOUND TUBULAR-REINFORCED ROTOR BLADE Final Report
David Wall, Dale Abildskov, and Larry Ashton Oct. 1973 115 p
(Contract DAAJ02-72-C-0013; DA Proj. 1F1-62208-A-170)
(AD-772947; USAAMRDL-TR-73-61) Avail: NTIS CSCL 01/3

The results of engineering design, fabrication and testing of filament-wound tubular-reinforced composite main rotor blades for the UH-1D helicopter are reported. Three blades were fabricated using wet winding, two using principally S-glass roving/epoxy and one using principally PRD-49 roving. In the course of the program, a design concept for making a highly redundant root-end attachment was developed and the fabrication feasibility was proven. The ability to calculate the structural characteristics was verified within the testing and fabrication tolerances. Author (GRA)

N74-18714# Rochester Univ., N.Y. Center for Visual Science.
VISUAL ELEMENTS IN FLIGHT SIMULATION
John Lott Brown Dec. 1973 74 p refs
(Contract N00014-67-A-0398-0007)
(AD-772586; TR-73-2) Avail: NTIS CSCL 01/3

The goal of airlines is to reduce to an absolute minimum the amount of time spent in aircraft for training. Simulators are cheaper and safer to operate than aircraft, although some maneuvers still must be learned in actual flight. Some aspects of aircraft control depend upon an exterior view from the aircraft of the outside visual world, but providing good specifications for just how to simulate the external visual world is far from simple. There is currently no solid scientific basis for cataloging visual cues with respect to their importance in aircraft control. The report constitutes a summary of the information gathered by the Working Group to remedy this situation and recommendations arising out of its deliberations. GRA

N74-18715# Rockwell International Corp., Columbus, Ohio. Aircraft Div.
CONTROL-BY-WIRE ACTUATOR MODEL DEVELOPMENT FOR AFCAS Final Technical Report, 2 Jan. 1973 - 10 Jan. 1974
J. Demarchi, N. Gianforcaro, R. Haning, R. Hupp, F. Malikowski, G. Maroscher, and B. Mathena Jan. 1974 84 p refs
(Contract N62269-73-C-0405)
(AD-772588; NR73H-107) Avail: NTIS CSCL 01/4

The report describes the design and fabrication of an engineering model, 8000 psi, control-by-wire, modular configured, aircraft type hydraulic servo actuator for the Navy sponsored AFCAS development program. The modular elements could be used to build up either a dual tandem, dual parallel, or simple servo actuator. The tandem and parallel configurations were controlled by two synchronized, single stage, spool/sleeve type flow control valves designed to operate at 8000 psi using MIL-H-83282 fluid. Each valve spool was coupled directly to and driven by a force motor with rare earth cobalt samarium permanent magnets and four armature coils for redundancy. A dual parallel linear variable differential transfer position feedback transducer was mounted inside the acutator piston rod. Steady-state performance tests were conducted on one spool/sleeve assembly and force motor. Author (GRA)

N74-18716# Bell Helicopter Co., Fort Worth, Tex.
COLD-WEATHER FLIGHT TESTS OF AN OH-58 HELICOPTER EQUIPPED WITH AN ELASTOMERIC-BEARING MAIN ROTOR
C. H. Fagan Aug. 1973 38 p refs
(Contract DAAH02-73-C-0024; DA Proj. 1F1-63209-DB-38)
(AD-772935; BHC-TR-299-099-644; USAAMRDL-TR-73-70) Avail: NTIS CSCL 01/3

The report contains the results of a flight test program conducted to investigate the characteristics of a main rotor equipped with elastomeric bearings operating at low temperatures. The helicopter used was an OH-58A, and the main rotor tested had elastomeric bearings in the pitch-change and flapping axes. The tests were conducted at Fort Wainwright, Alaska, and operation at temperatures of 48F, 5F, -9F, -13F, -29F, and -52F was evaluated. Normal rotor control was obtained down to temperatures of -13F. At lower temperatures, elastomer stiffening causes increased control system loads, which limit operation. (Modified author abstract) GRA

N74-18717# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), CH-47A ENGINE Interim Report, Jan. 1964 - Jul. 1973
Dec. 1973 23 p
(AD-772978; USAAVSCOM-TR-73-29) Avail: NTIS CSCL 01/3

The report is designed to illustrate cost savings which would result from specific efforts in the areas of product improvement in quality and design. For the purpose of this study the cost

savings produced in the area of product improvement are based on total elimination of a certain failure mode or modes. Appropriate modes are chosen because of their proportion of the total removals or their proportion in combination with other similar modes. These eliminated removals are then assumed to follow the distribution of the remaining removal modes. The actual cost savings are determined from the increase in the mean time to removal based on the new removal distributions. GRA

N74-18718# Army Air Mobility Research and Development Lab., Fort Eustis, Va.
THE EFFECTS OF SAND PARTICLES ON SMALL, INTRICATE MECHANICAL COMPONENTS Final Report
Donald R. Artis, Jr. Oct. 1973 151 p refs
(DA Proj. 1F1-62205-A-119)
(AD-772977; USAAMRDL-TR-73-93) Avail: NTIS CSCL 01/3

The report presents the results of a series of tests conducted to investigate the failure mode of binding caused by sand particles in small, intricate mechanical components. These tests were prompted by the large number of failures of components where the suspected mode of failure was binding caused by sand ingestion. The armament system circuit breaker of the AH-1G helicopter was selected as the device to be tested. (Modified author abstract) GRA

N74-18719# Naval Postgraduate School, Monterey, Calif.
HYDRAULIC RAM SHOCK WAVE AND CAVITATION EFFECTS ON AIRCRAFT FUEL CELL SURVIVABILITY M.S. Thesis
Dwight Patrick Holm Sep. 1973 84 p refs
(AD-772744) Avail: NTIS CSCL 10/2

Hydraulic ram is the dynamic loading of fuel tanks when impacted by bullets or other projectiles. During impact and penetration of the fuel cell, intense pressure waves are generated by the projectile. A ballistic range was built and experimental testing was conducted to study hydraulic ram phenomena. A 0.22 caliber rifle was used to accelerate projectiles at velocities in the range of 0.38 km/sec into a transparent, water filled tank. Shape and intensity of the shock wave pressure pulse induced as a result of projectile impact were determined using a dual shadowgraph system. Peak pressures were found to be as high as 4,500 x kg/sq cm. The rate of energy transfer to the fluid by the projectile was determined experimentally and compared with analytical predictions. A characteristic time was defined establishing the separation point between the shock and cavity phases of hydraulic ram. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N74-18720 Tulane Univ., New Orleans, La.
INVESTIGATION OF ENERGY CONVERSION IN RAPIDLY CYCLING FUEL CELLS, 1. A SYSTEM FOR STUDYING THE SURFACE DIFFUSION OF HYDROGEN ON METALS, 2 Ph.D. Thesis
Vasudev Dayanand Prabhu 1973 268 p
Avail: Univ. Microfilms Order No. 74-320

By rapidly cycling the fuel cell, energy conversion techniques can be applied to design a mechanical device called an electrochemical pump. The cycle efficiency and performance of the electrochemical pump is studied by means of transient fuel cell and electrolysis operation of the ion exchange membrane fuel cell. Performance characteristics of the cell during rapid cycling operation are presented and critically analyzed. A system for experimentally measuring surface diffusion is designed and constructed. The surface diffusion of tritium can be obtained by monitoring the radioactivity of adsorbed tritium versus distance along a metal surface with the help of a low energy beta detector. A critical analysis of results in terms of energies of tritium and noise level encountered during experiments is presented.
Dissert. Abstr.

N74-18721*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
COMPARATIVE EVALUATION OF SOLAR, FISSION, FUSION, AND FOSSIL ENERGY RESOURCES. PART 1: SOLAR ENERGY Final Report
J. R. Williams 23 Jan. 1974 122 p refs
(Grant NGR-11-002-166)
(NASA-CR-137242) Avail: NTIS HC $9.25 CSCL 10A

The utilization of solar energy to meet the energy needs of the U.S. is discussed. Topics discussed include: availability of solar energy, solar energy collectors, heating for houses and buildings, solar water heater, electric power generation, and ocean thermal power. F.O.S.

N74-18722*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A FLIGHT-TYPE LAMINAR RADIATOR WITH A BRAYTON POWER SYSTEM
Theodore C. Cintula, George M. Prok, and Robert B. Smith Washington Mar. 1974 49 p refs
(NASA-TN-D-7573; E-7716) Avail: NTIS HC $3.25 CSCL 10A

A space-type laminar flow radiator was designed and integrated with a 2- to 15-kilowatt Brayton electrical power generating system. The design, fabrication, and testing of this radiator are presented. Test results include performance under steady state and transient conditions. Included in the transient results is performance in a simulated low earth orbit. Results show that the computer design is conservative. Orbital transients show that a further reduction in radiator area over that determined from steady state conditions is possible. Radiator efficiency was always greater than 83 percent. Author

N74-18723# Joint Publications Research Service, Arlington, Va.
THERMAL CYCLE AND EFFICENCY OF A VERSATILE POWER UNIT WITH A MAGNETOHYDRODYNAMIC GENERATOR AND THERMOELECTRIC GENERATOR
V. A. Kirillin, A. Ye. Sheyndlin, Ye. M. Shelkov, Ye. V. Shishkov, S. A. Pashkov, and V. M. Latyshev 1 Mar. 1974 8 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur, Akad. Nauk SSSR (Moscow), v. 11, no. 5, 1973 p 1088-1091
(JPRS-61359) Avail: NTIS HC $4.00

A MHD generator circuit is described with an overload mode capacity making operation possible in a wide range of loads.
Author

N74-18724# National Bureau of Standards, Washington, D.C. Building Environment Div.
TECHNICAL OPTIONS FOR ENERGY CONSERVATION IN BUILDINGS Final Report
Jul. 1973 186 p refs Prepared for Natl. Conf. of States on Building Codes and Standards and NBS Joint Emergency Workshop on Energy Conserv. in Buildings, Washington, D. C., 19 Jun. 1973
(NBS-TN-789) Avail: SOD HC $2.35 Domestic Postpaid or $2.00 GPO Bookstore as C13.46:789

Actions pertinent to existing buildings and new buildings are described. Regarding existing buildings, principal topics include summer cooling, winter heating, and other energy conserving features--i.e., insulation, fenestration, lighting, appliances, domestic hot water, and human comfort. Suggested actions include those which can be accomplished voluntarily or without expense, and also actions which require some modest effort or expense on the part of the building owner or occupant. Regarding new buildings, energy conservation actions are described that deal with building design and mechanical systems. The report concludes with a summary of mechanisms for implementation of such actions and criteria for use in evaluation of them. Author

N74-18725# Union Electric Co., St. Louis, Mo.
RECYCLING SOLID WASTE FOR UTILITY FUEL AND RECOVERY OF OTHER RESOURCES
Earl K. Dille and David L. Klum 1973 17 p refs Presented at 1973 Frontiers of Power Technol., Stillwater, Okla. Sponsored

by City of St. Louis
Avail: NTIS HC $4.00

Full scale prototype testing to determine the feasibility of processing municipal solid waste to produce supplementary fuel for electric utility boilers and to recover recycleable, non-combustible materials has been conducted. Operation of the prototype was satisfactory during the first year with the exception of milled solid waste mechanical handling problems. Crushed glass in the solid waste resulted in excessive wear and maintenance of solid waste pneumatic transport piping bends and elbows. Metals and oversize pieces of wood caused frequent stoppages of solid waste transport system mechanical feeding equipment. The mechanical handling problems were identified soon after the initial operation and it appeared clear that the material presented no other operating problems at the processing plant or in furnace combustion. Consequently, engineering design and purchase of a mechanical air separator (air classifier) was initiated to provide for the removal of glass, metals, and other unburnable materials. Author

N74-18726*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMOELECTRIC POWER SYSTEM Patent Application
Ambrose W. Byrd, inventor (to NASA) Filed 19 Mar. 1974 10 p
(NASA-Case-MFS-22002-1; US-Patent-Appl-SN-452769) Avail: NTIS HC $4.00 CSCL 10A

A thermoelectric power system adaptable for use in outer space is reported in which a nuclear reactor heats a working fluid, which in turn supplies heat to thermoelectric generators spaced about a ring shaped support. A first heat pipe is employed to couple heat between the hot fluid and hot junction of the thermoelectric element of each generator, and a second heat pipe couples heat away from the cold junction of each thermoelectric element. Each of the second heat pipes are elongated flexible units adapted to be folded upon launch of the system of a space vehicle and thereafter extended in space to provide a substantial area of radiation of heat to be discharged. NASA

N74-18727*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR THERMODYNAMIC ANALYSIS OF OPEN CYCLE MULTISHAFT POWER SYSTEM WITH MULTIPLE REHEAT AND INTERCOOL
Arthur J. Glassman Washington Mar. 1974 66 p ref
(NASA-TN-D-7589; E-7518) Avail: NTIS HC $3.75 CSCL 10A

A computer program to analyze power systems having any number of shafts up to a maximum of five is presented. On each shaft there can be as many as five compressors and five turbines, along with any specified number of intervening intercoolers and reheaters. A recuperator can be included. Turbine coolant flow can be accounted for. Any fuel consisting entirely of hydrogen and/or carbon can be used. The program is valid for maximum temperatures up to about 2000 K (3600 R). The system description, the analysis method, a detailed explanation of program input and output including an illustrative example, a dictionary of program variables, and the program listing are explained. Author

N74-18728# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Atmospheric Physics.
SOLAR RADIATION STATISTICS FOR AUSTRALIA
G. W. Paltridge 1974 24 p refs
(ISBN-0-643-00082-8; Paper-23) Avail: NTIS HC $4.25

Contour maps of seasonal average solar radiation parameters are computed from detailed cloud cover information. The parameters include direct and global fluxes on horizontal, inclined and 'sun-tracking' surfaces. Contour maps of cloud cover probabilities are included. Author

N74-18729# Los Alamos Scientific Lab., N.Mex.
AND WHAT IF WE WERE TO SWITCH TO HYDROGEN?
Yu. Medvedev and E. Muslin 1973 25 p Transl. into ENGLISH from Izobret. Izobret. i Ratsionalizatsiya, Irkutskii (Irkutsk), no. 318, 1973 p 40-44
(LA-TR-73-40) Avail: NTIS HC $3.25

The use of ordinary water as a fuel source from which to derive hydrogen is proposed. The production of hydrogen by the reactions of the Mark-1 process and the process with iron-carbon catalyzers is discussed. The pipelines and transport of hydrogen with its applications to fuel sources or everyday life are discussed. It is predicted that it will be possible to establish a powerful food chain depending neither on agriculture nor on oil reserves and based only on atomic energy. Scientists have been trying, with the aid of hydrogen yeast to obtain food from carbon dioxide, mineral salts, and hydrogen obtained with electrolysis of water by current from solar batteries. The same hydrogen and oxygen could serve as an energy source for fuel cells. Author (NSA)

N74-18730# Electricity Commission of New South Wales, Sydney (Australia).
ELECTRICITY: THE CONVERSION INDUSTRY
N. B. Heal 1973 10 p refs
(NP-19837) Avail: AEC Depository Libraries HC $3.00

Planning of future electric power supplies is considered with specific reference to Australia. Topics covered include fuel reserves, fuel costs, electricity supply today, planning future supplies, energy transport, and the effect of changes on the consumer. Coal, uranium, and possibly natural gas coal reserves are clearly adequate to provide a supply of fuel at reasonable costs for power generation for well into the next century. In comparison with uranium and coal, known reserves of crude oil and natural gas in Australia are relatively small. NSA

N74-18731# Atomic Energy Commission, Washington, D.C.
PROCESS FOR THE SIMULTANEOUS UTILIZATION OF GEOTHERMIC AND HYDRODYNAMIC ENERGY
J. E. Tavip [1974] 7 p Transl. into ENGLISH from the Spanish
(AEC-TR-7475) Avail: NTIS HC $3.00

A process is described for the utilization of hydrodynamic energy produced by water falling through a pipe inserted deeply into the earth's crust at a point where the high temperature will produce steam and is returned to the earth surface through another pipe as steam. The waterfall created by this perforation is utilized by turbines suitable for the production of electric energy while the steam produced spurts from the surface of the earth and can be used as a source of energy with multiple applications. NSA

N74-18732# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
OPTIMIZATION OF A RADIOISOTROPE THERMOELECTRIC GENERATOR (RTG) [OTTIMIZZAZIONE DI UN CONVERTITORE TERMOELETTRICO A RADIOISOTOPI (RTG) PER PRODUZIONE DI ENERGIA ELETTRICA A BORDO DI SATELLITI]
P. Campanaro and G. Genta Nov. 1973 33 p refs In ITALIAN; ENGLISH summary
(Publ-152) Avail: NTIS HC $4.75

The numerical modeling and design optimization of a radioisotope thermoelectric generator for spacecraft power supply application is discussed. Results obtained confirm the possibility of minimizing the weight of the system by an accurate selection of temperature levels and geometrical dimensions of the components. The numerical data obtained are well correlated with experimental evidence. ESRO

N74-18733# Royal Aircraft Establishment, Farnborough (England).
OPTIMISATION OF SOLAR CELL SHIELDING FOR GEOSTATIONARY MISSIONS
M. W. Walkden Aug. 1973 41 p refs
(RAE-TR-73105; BR36625) Avail: NTIS HC $5.25

Equivalent 1MeV electron fluences, end of life output powers and power to weight ratios are estimated for solar cells in a five year geostationary mission beginning in 1975. Cell thicknesses from 125 to 300 microns, covers lip thicknesses from 25 to 300 microns, and rear shielding typical of rigid and lightweight flexible arrays are considered. It is concluded that the thinnest cells and shielding give the best power to weight ratio, although the choice for a particular spacecraft will be influenced by considerations of availability, cost, fragility and array area. Author (ESRO)

N74-18734*# Naval Avionics Facility, Indianapolis, Ind. Quality Evaluation and Engineering Lab.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS
J. D. Harkness 2 Jan. 1974 16 p
(NASA Order S-23404-G)
(NASA-CR-137227; AD-771993; QEEL/C-74-1) Avail: NTIS HC $4.00 CSCL 10/3

The purpose of this evaluation test program is to insure that all cells put into the life cycle program are of high quality by the screening of cells found to have electrolyte leakage, internal shorts, low capacity, or inability of any cell to recover its open-circuit voltage above 1.150 volts during the internal short test. GRA

N74-18735# KSW Electronics, Inc., Burlington, Mass.
LITHIUM IMPLANTED SOLAR CELLS, DATA Final Report, 1 Jun. - 31 Jul. 1973
Donald A. Smith and Jerome L. Hartke 31 Jul. 1973 23 p refs
(Contract F19628-73-C-0214; AF Proj. 8659)
(AD-772817; AFCRL-TR-73-0493) Avail: NTIS CSCL 10/2

The report contains the identification and processing description of all samples processed and the tabulated measurement data obtained on phosphorus diffused, lithium implanted, p-type silicon solar cell blanks. Author (GRA)

N74-18736# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
SIMULATION OF HYDRAZINE-DRIVEN EMERGENCY POWER GENERATOR Final Report
David Walter Williams Nov. 1973 85 p refs
(Contract DACA88-73-A-0002)
(AD-771158/3GA; CERL-TM-E-19) Avail: NTIS HC $3.75 CSCL 10/2

The result of the study is a computer program which simulates the performance of a turbo-alternator power system under varying load conditions. The propellant used in this model is hydrazine and the design output level of the alternator is 3mW. The computer program uses the technique of Newton-Raphson for the simultaneous solution of nonlinear equations. The program is set up to allow easy modification to the system equations. The decomposition chamber, turbine stages, and exhaust system are the main components simulated in the program. (Modified author abstract) Author (GRA)

N74-18737# Energy Research Corp., Bethel, Conn.
HIGH ENERGY SEALED NICKEL-ZINC BATTERIES Final Annual Report, 1 Mar. 1972 - 1 Oct. 1973
Allen Charkey Nov. 1973 44 p
(Contract DAAB07-72-C-0114; DA Proj. 1T7-62705-A-053)
(AD-772944; ECOM-0114-F) Avail: NTIS CSCL 10/3

A sealed 7 Ah/6.5 volt nickel-zinc battery has been developed which is capable of 160-200 cycles of operation at approximately 60% depth of discharge at the C/4 rate. Initial energy density obtained was 28 Wh/lb at the C/4 discharge rate. The battery will deliver about 40% of its energy at -20F at the C/4 rate. With silver amalgam oxygen recombination electrodes the battery is capable of continuous overcharge at 0.5 amperes at a safe steady state pressure below 50 psi. Improved inorganic separators (ERC-2002) have been developed which are chemically inert in KOH, have a uniform pore size distribution and stop the occurrance of zinc dendrites. The primary cause of failure of the battery was found to be from the zinc electrode failure. (Modified author abstract) GRA

N74-18738# Army Electronics Command, Fort Monmouth, N.J.
ZINC-AIR (OXYGEN) CELL STUDIES
Otto C. Wagner Nov. 1973 20 p refs
(DA Proj. 1T7-62705-A-053)
(AD-772903; ECOM-4166) Avail: NTIS CSCL 10/3

Shorting by zinc penetration through the separator layers was prevented in zinc-air and zinc-oxygen cells by inserting a 10 mil thick partially wetproofed porous nickel layer within the layers of separator material. Excellent capacity maintenance was attained for 50 cycles from a zinc-air cell by: (a) containing the zinc anode within a plastic frame onto which the separator layers were epoxy-sealed, (b) blocking the edges of the anode with a thin plastic shield, and (c) providing a 20 to 30 mil thick electrolyte channel between the charging electrodes and separator clad anode. Preliminary results from sealed zinc-oxygen cell investigations indicate that good capacity maintenance can be attained by: (a) sealing the charging electrode within a plastic frame onto which a layer of potassium titanate paper is epoxy-sealed to the edge of the electrolyte face and a thin porous teflon layer is cemented to the gas face, (b) using silver-amalgam catalyzed oxygen electrodes, and (c) adding 5% potassium titanate powder to the zinc oxide mix. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N74-18739 Texas A&M Univ., College Station.
RESPONSE OF SELECTED MICROORGANISMS TO A SIMULATED MARTIAN ENVIRONMENT Ph.D. Thesis
Terry Lynn Foster 1973 99 p
Avail: Univ. Microfilms Order No. 74-1010

Microorganisms capable of growth at 7 C were enumerated and isolated from soil samples from the manufacture area (Denver, Colorado) and assembly area (Cape Kennedy, Florida) of the Viking spacecraft. Temperature requirements were determined for these isolates, and those growing at 3 C, but not at 32 C were designated as obligate psychrophiles. These were identified to major generic groups, and the population density of obligate psychrophiles from the various groups was determined. It was found that soil samples from the manufacture area contained obligate psychrophiles, none of which was a sporeformer, which comprised about 15% of the population isolated at 7 C. The samples from Cape Kennedy contained psychrophilic populations which made up about 16% of the population isolated at 7 C, and 5% of these were aerobic sporeformers. Dissert. Abstr.

N74-18740 Michigan Univ., Ann Arbor.
RADIATION PROTECTION GUIDES FOR LONG RANGE SPACE MISSIONS, VOLUME 1. RADIOLOGICAL HEALTH ASPECTS OF FABRICATING OPERATIONS WITH THORIATED METALS, VOLUME 2 Ph.D. Thesis
Julian Manly Earls 1973 144 p
Avail: Univ. Microfilms Order No. 74-661

Radiation protection guides for future space missions are established based on evaluation of data on effects of conventional radiation exposures on animals and man. Airborne radioactivity levels due to the use of thoriated electrodes for welding operations are reexamined. These results are compared to hazards due to the use of other thoriated metals for machining operations. It is concluded that except for sanding and cutting operations, there is no significant difference between the radiological health hazards due to the use of thoriated tungsten electrodes and other 2 percent thoriated materials. Dissert. Abstr.

N74-18741 University of Southern Calif., Los Angeles.
APPARENT ADRENAL AND PULMONARY ACCLIMATION TO A HYPEROXIC HYPOBARIC ENVIRONMENT Ph.D. Thesis
Billy Joe Pfoff 1973 157 p
Avail: Univ. Microfilms Order No. 73-31663

The purpose of this study was to evaluate the effects on the pulmonary and adrenal cortex structures in mice after long-duration exposure to 100 percent oxygen at a partial pressure of 632 mm Hg and below. The findings show that the pulmonary structures were the most vulnerable target for oxygen toxicity when exposed to increased partial pressures of oxygen. However, it appears that in mice, an adaptive process can occur which can enable them, when exposed to progressively increasing oxygen partial pressures, to survive long-term exposure to an environment where survival would not normally be possible. It appears that this adaptation involves hematological, metabolic, hormonal, and nervous system interaction and adjustment. Dissert. Abstr.

N74-18742* + National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 125
Feb. 1974 98 p refs
(NASA-SP-7011(125)) Avail: NTIS HC $4.00 CSCL 06E

This special bibliography lists 323 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1974. Author

N74-18743*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF WEIGHTLESSNESS AND DECREASED GRAVITATION
Ye. A. Kovalenko Washington NASA Mar. 1974 32 p refs Translation into ENGLISH from "Deystviye Nevesomosti i Ponizhennoy Gravitatsii" Moscow, Meditsina Press, 1973 p 312-332
(Contract NASw-2485)
(NASA-TT-F-15323) Avail: NTIS HC $4.75 CSCL 06S

Effects of weightlessness and diminished gravitation are discussed as reflected in data obtained from terrestrial simulated experiments and from spaceflight data. Conclusions are drawn to the effect that weightlessness causes extensive metabolic and functional changes in both human and animal organisms. Weightlessness is one of the primary factors causing detraining as an insurmountable problem and success has been achieved in preconditioning astronauts for weightlessness. The disadvantages of aircraft simulator experiments are pointed out as are many problems in this field which yet remain unsolved. Author

N74-18744*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF REPEATED RESTRICTIONS OF MOTOR ACTIVITY UPON SYSTOLIC BLOOD PRESSURE OF ALBINO RATS
M. Poppei and K. Hecht Washington NASA Mar. 1974 12 p refs Transl. into ENGLISH from Acta Biol. Med. Ger. (Berlin), v. 27, 1971 p 297-306
(Contract NASw-2485)
(NASA-TT-F-15390) Avail: NTIS HC $4.00 CSCL 06S

The influence of repeated restrictions of motor activity on systolic blood pressure was examined for seven and a half months in 54 male and female albino rats. With increasing duration of restraint, blood pressure readings from 114 to 146 torr with a high of 240 were obtained. Blood pressure remained high for five weeks following the experiment, leading to the conclusion that the effects are chronic. Author

N74-18745# Joint Publications Research Service, Arlington, Va.
HORIZONS IN SPACE BIOLOGY AND MEDICINE
N. Gurovskiy 28 Mar. 1974 21 p Transl. into ENGLISH from various Russian publications
(JPRS-61600) Avail: NTIS HC $4.25

Aerospace medicine data were applied to ordinary medicine, gravitational biology, and an artificial biosphere experiment. For individual titles, see N74-18746 through N74-18749.

N74-18746 Joint Publications Research Service, Arlington, Va.
SPACE MEDICINE AND ITS CONTRIBUTION TO HUMAN WELFARE
N. Gurovskiy and A. Koreshkov *In its* Horizons in Space Biol. and Med. (JPRS-61600) 28 Mar. 1974 p 1-4 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow), 31 Dec. 1973 p 3 (For availability see N74-18745 10-04)

Aerospace overloading effects on the human body are studied and applied to physiology, psychology, and hygiene of man on earth. Equipment used for monitoring man in space is applied to systems for observing very ill patients in clinics and hospitals and also for observing human performance in sports. A return to general practicing in medicine is proposed rather than specializing in a narrow field; this is made possible by the use of computer data banks. J.A.M.

N74-18747 Joint Publications Research Service, Arlington, Va.
APPLICABILITY OF FINDINGS IN SPACE MEDICINE IN ORDINARY MEDICINE
N. Gurovskiy and A. Yegorov *In its* Horizons in Space Biol. and Med. (JPRS-61600) 28 Mar. 1974 p 5-9 Transl. into ENGLISH from Izv. (Moscow), 5 Jan. 1974 p 5 (For availability see N74-18745 10-04)

The lack of knowledge in the medical profession, concerning the requirements or definition of a healthy human, is discussed. New methods made possible by aerospace technology were used to detect latent disorders and to manufacture reliable medical instrumentation for constant remote monitoring. J.A.M.

N74-18748 Joint Publications Research Service, Arlington, Va.
GRAVITATIONAL BIOLOGY
N. Dubinin *In its* Horizons in Space Biol. and Med. (JPRS-61600) 28 Mar. 1974 p 10-13 Transl. into ENGLISH from Pravada (Moscow), 6 Jan. 1964 p 3 (For availability see N74-18745 10-04)

The effects of gravitation on animal and plant life when they emerged from the sea to live on land are reviewed. The post flight physiological changes in cosmonauts are discussed, including the impairment of sensomotor, vestibular, and neuromuscular systems and coordination of vertical pose movement. Heredity and the changes in molecular structure due to weightlessness are also considered. J.A.M.

N74-18749 Joint Publications Research Service, Arlington, Va.
EXPERIMENT WITH AN ARTIFICIAL BIOSPHERE DESCRIBED c05
B. Konovalov *In its* Horizons in Space Biol. and Med. (JPRS-61600) 28 Mar. 1974 p 14-19 Transl. into ENGLISH from Izvestiya (Moscow), 27 Oct. 1973 p 5 (For availability see N74-18745 10-04)

An experiment is described where human subjects spent six months in an artificial biosphere. This biosphere was made of four 75 cubic meter compartments. The first compartment consisted of a shower, wardroom, kitchen, miniworkshop, and living quarters. The other three compartments comprised plant gardening (wheat, vegetables, and Chlorella algae). The plants were used to give oxygen and take up the carbon dioxide expended by the subjects. J.A.M.

N74-18750*# Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex. Dept. of Physiology.
SPECIALIZED PHYSIOLOGICAL STUDIES IN SUPPORT OF MANNED SPACE FLIGHT Annual Research Report, 3 Jan. - 31 Dec. 1973
U. C. Luft Feb. 1974 46 p refs
(Contract NAS9-12572)
(NASA-CR-134210) Avail: NTIS HC $5.50 CSCL 06S

Research in aerospace medicine is presented. The reports discussed include: circulatory and respiratory transients during and after orthostasis and the effects of beta adrenergic blockade; the determination of total body water by an ethanol dilution method; and increased total respiratory conductance breathing 100% oxygen (forced oscillation method). F.O.S.

N74-18751*# Techtran Corp., Glen Burnie, Md.
A NEW METHOD TO PRODUCE AORTIC ANEURYSMS IN RABBITS BY EXPERIMENTALLY RESTRICTING THEIR MOVEMENT
W. W. Tjawokin Washington NASA Mar. 1974 8 p Transl. into ENGLISH from Arch. Pathol. Anat. Physiol. (West Berlin), v. 351, 1970 p 340-346
(Contract NASw-2485)
(NASA-TT-F-15394) Avail: NTIS HC $4.00 CSCL 06S

The thoracic aortas of 12 male chinchilla rabbits were constricted to various degrees by ligatures and the animals subjected to varying degrees of immobility confinement to investigate the question as to whether these factors contribute to the development of aortic aneurysms. Studies indicate the development of aortic aneurysms depends on the degree of restriction of movement, and the degree of constriction of the aorta by the ligature. Author

N74-18752*# Techtran Corp., Glen Burnie, Md.
EFFECT OF SHOCK WAVES
P. I. Burenin Washington NASA Mar. 1974 23 p refs Transl. into ENGLISH from the publ. "Patologicheskaya Fiziologiya Ekstremalnykh Sostoyaniy" Moscow, Med., 1973 p 312-322
(Contract NASw-2485)
(NASA-TT-F-15317) Avail: NTIS HC $4..25 CSCL 06S

Studies of the pathogenetic effects of shock waves from explosions are reviewed. The characteristics of an air blast are described. The interaction of such a blast on the human body, and the mechanism of resulting damage are investigated with particular attention being devoted to the role of air blast parameters in injuries, and to the characteristics of pathogenesis for direct injuries. The problems associated with protection against and treatment of air blast injury are examined. Author

N74-18753*# Techtran Corp., Glen Burnie, Md.
X-RAY CINEMATOGRAPHIC STUDIES OF THE CENTRAL CIRCULATORY ORGANS DURING THERAPEUTIC BATHS AND DURING HYDROSTATIC PRESSURE INCREASE. THEIR TECHNIQUE, RESULTS AND DEVELOPMENTAL POSSIBILITIES
Friedrich Ekert Washington NASA Mar. 1974 28 p refs Transl. into ENGLISH from Arch. Physik. Therapie (Leipzig), v. 6, 1956 p 66-82
(Contract NASw-2485)
(NASA-TT-F-15398) Avail: NTIS HC $4.50 CSCL 06S

The use of bath tubs of various shapes, ranging from shallow flat to tall structure the height of a man in which subjects and patients were subjected to X-ray kinomatography, is discussed. The changes in size and function of the heart and lungs were recorded and studied during therapeutic baths and hydrostatic pressure increase. Author

N74-18754*# National Aeronautics and Space Administration, Washington, D.C.
FIFTH SYMPOSIUM ON THE ROLE OF THE VESTIBULAR ORGANS IN SPACE EXPLORATION
1973 275 p refs Symp. held at Pensacola, Fla., 19-21 Aug. 1970
(NASA-SP-314; LC-72-600319) Avail: NTIS MF $1.45; SOD $4.05 CSCL 06P

Vestibular problems of manned space flight are investigated for weightlessness and reduced gravity conditions with emphasis on space station development. Intensive morphological studies on the vestibular system and its central nervous system connections are included. For individual titles, see N74-18755 through N74-18778.

N74-18755* National Aeronautics and Space Administration, Washington, D.C.
THE SPACE STATION: KEY TO LIVING IN SPACE **c30**
Douglas R. Lord *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 3-11 (For availability see N74-18754 10-04)
CSCL 22A

Design and scientific equipment for the Manned Orbiting Laboratory and Skylab are elaborated. Multideck designs accomodate both zero gravity and artificial gravity conditions as well as a core module potentially useful as a planetary mission module for a 12-man crew. Artificial gravity approaches consider assembly rotation and differential spin rates for the various decks. Counterrotation systems are projected to go from a station to a 50-man space base concept. G.G.

N74-18756* National Aeronautics and Space Administration, Washington, D.C.
FINDINGS ON AMERICAN ASTRONAUTS BEARING ON THE ISSUE OF ARTIFICIAL GRAVITY FOR FUTURE MANNED SPACE VEHICLES **c05**
Charles A. Berry *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 15-22 refs (For availability see N74-18754 10-04)
CSCL 06S

Findings for American astronauts are reviewed that may indicate some alteration in vestibular response related to exposure to zero gravity. Of 25 individuals participating in Apollo missions 7 through 15, nine have experienced symptomatology that could be related to motion sickness. The apparent divergence between these results and those from the Soviet space program, which initially appears great, may reflect the greater emphasis given by Soviet investigators to vestibular aberrations. Presently the incidence of motion sickness, long known as an indicator of vestibular disturbance, seems too low to warrant any positive statement regarding inclusion of an artificial gravity system in future long term space missions. Where motion sickness has occurred, adaptation to weightlessness has always resulted in abatement of symptoms. In the absence of biomedical justification for incorporating artificial gravity systems in long term space flight vehicles, engineering considerations may dictate the manner in which the final ballot is cast. Author

N74-18757* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN OVERVIEW OF ARTIFICIAL GRAVITY **c05**
Ralph W. Stone, Jr. *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 23-33 refs (For availability see N74-18754 10-04)
CSCL 05E

The unique characteristics of artificial gravity that affect human performance and physiology in an artificial gravity environment are reviewed. The rate at which these unique characteristics change decreases very rapidly with increasing radius of a rotating vehicle used to produce artificial gravity. Reducing their influence on human performance or physiology by increasing radius becomes a situation of very rapidly diminishing returns. A review of several elements of human performance has developed criteria relative to the sundry characteristics of artificial gravity. A compilation of these criteria indicates that the maximum acceptable rate of rotation, leg heaviness while walking, and material handling are the factors that define the minimum acceptable radius. The ratio of Coriolis force to artificial weight may also be significant. Based on current knowledge and assumptions for the various criteria, a minimum radius between 15.2 and 16.8 m seems desirable. Author

N74-18758* Naval Aerospace Medical Research Lab., Pensacola, Fla.
VESTIBULAR MECHANISMS UNDERLYING CERTAIN PROBLEMS IN A ROTATING SPACECRAFT
Ashton Graybiel *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 35-39 refs (For availability see N74-18754 10-04)
CSCL 06S

Vestibular side effects are discussed with the aid of a conceptual framework based on an analysis of vestibular input-output relations. These side effects tend to fall into two main categories: (1) Reflex phenomena, and (2) motion sickness, a delayed epiphenomenon. Although the symptomatology of motion sickness is similar wherever experienced, both the eliciting stimuli and the opportunity to adapt may differ in different motion environments. These differences not only are exemplified when motion sickness is compared in a weightless and in a rotating environment, but they also point to important differences in the problem of preventing (or treating) motion sickness in these two very different environments. Author

N74-18759* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE STATION CAPABILITY FOR RESEARCH IN ROTATIONAL HYPOGRAVITY **c30**
George Keller *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 43-53 refs (For availability see N74-18754 10-04)
CSCL 22A

Certain capabilities provided in preliminary designs of orbital space stations for research in rotational hypogravity are outlined. Also indicated are alternative configurations that are being considered. Principal addressees are members of an international community of physiologists whose work in earth oriented, as well as space oriented, physiology can be supported through observation under the background environment of null gravity. Their participation in originating and devising advanced experiments and in developing requirements is expected to enhance final design of the selected space station and to make the research program more meaningful. Author

N74-18760* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN OF EXPERIMENTAL STUDIES OF HUMAN PERFORMANCE UNDER INFLUENCES OF SIMULATED ARTIFICIAL GRAVITY **c05**
William M. Piland, H. George Hausch, Grady V. Maraman, and

James A. Green (North Am. Rockwell Corp.) *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 55-65 refs (For availability see N74-18754 10-04)
CSCL 05E

A ground based research program is now being undertaken to provide data concerning the effects of a rotating environment on man's ability to adequately perform gross and fine psychomotor tasks. Emphasis is being placed on establishing the levels of artificial gravity and rates and radii of rotation required in future space systems for preservation of crew performance and comfort. An experimental study utilizing a rotational facility to investigate crew mobility, cargo transfer and handling, and fine motor coordination at radii up to 24 meters and at rotational rates up to 5 rpm is reported. Author

N74-18761* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOCOMOTION IN A ROTATING ENVIRONMENT **c05**
William Letko *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 67-72 refs (For availability see N74-18754 10-04)
CSCL 05E

A rotating space station simulator is being used to obtain data on man's performance in a rotating environment. At present the facility is being used to assess the effects of rotation on man's walking capabilities on circular and flat walls at g-levels from 0.05 to 0.75g. Some of the preliminary results are reviewed. Author

N74-18762* Naval Aerospace Medical Research Lab., Pensacola, Fla.
SOME PHYSIOLOGICAL ASPECTS OF ARTIFICIAL GRAVITY **c05**
D. B. Cramer and Ashton Graybiel *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 73-83 refs (For availability see N74-18754 10-04)
CSCL 05E

The effects of increasing artificial gravity exposure on four aspects of physiological fitness are examined in four young men who, prior to exposure, were deconditioned with bed-rest and water immersion. The four aspects of physiological fitness are orthostatic tolerance, exercise tolerance, forearm endurance, and maximum strength. Orthostatic tolerance was sharply reduced by deconditioning and was substantially improved by walking in simulated lunar gravity (1/6 g) for 2.5 hours daily for 7 days or by walking in 1/2 g and 1 g for 1 hour daily for 3 days. Exercise tolerance was also sharply reduced by deconditioning but did not significantly improve with increasing g-exposure. Walking in 1 g for 1 hour daily for 3 days raised exercise tolerance only a little above the low produced by deconditioning. Forearm endurance and maximum strength were relatively unaffected by deconditioning and subsequent g-exposure. Author

N74-18763* Leicester Univ. (England).
EFFECTS OF VISUAL REFERENCE ON ADAPTATION TO MOTION SICKNESS AND SUBJECTIVE RESPONSES EVOKED BY GRADED CROSS-COUPLED ANGULAR ACCE'ERATIONS **c05**
James T. Reason and Elgin Diaz *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 87-97 refs (For availability see N74-18754 10-04)
CSCL 05E

Three groups of 10 subjects each were exposed to stepwise increments of cross coupled angular accelerations in three visual modes: internal visual reference (IVR), external visual reference (EVR), and vision absent (VA). The subjects in the IVR condition required significantly greater amounts of stimulus exposure to neutralize their illusory subjective reactions. They also suffered a greater loss of well-being and a more marked incidence of motion sickness than did subjects in the EVR and VA conditions. The same 30 subjects were reexposed to the same graded cross coupled stimulation 1 week later. This time, however, all the subjects were tested under only the IVR condition. All three groups showed some positive transfer of adaptation, but only the IVR-IVR combination required significantly fewer head motions to achieve the same level of adaptation on the second occasion. Taken overall, however, the most efficient and least disturbing route to adaptation at the completion of the second test was via the VA-IVR combination. Author

N74-18764* Naval Aerospace Medical Research Lab., Pensacola, Fla.
PERCEPTION OF THE UPRIGHT AND SUSCEPTIBILITY TO MOTION SICKNESS AS FUNCTIONS OF ANGLE OF TILT AND ANGULAR VELOCITY IN OFF-VERTICAL ROTATION
Earl F. Miller, II and Ashton Graybiel *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 99-103 refs (For availability see N74-18754 10-04)
CSCL 06E

Motion sickness susceptibility of four normal subjects was measured in terms of duration of exposure necessary to evoke moderate malaise (MIIA) as a function of velocity in a chair rotated about a central axis tilted 10 deg with respect to gravitational upright. The subjects had little or no susceptibility to this type of rotation at 2.5 and 5.0 rpm, but with further increases in rate, the MIIA endpoint was always reached and with ever shorter test durations. Minimal provocative periods for all subjects were found at 15 or 20 rpm. Higher rotational rates dramatically reversed the vestibular stressor effect, and the subjects as a group tended to reach a plateau of relatively low susceptibility at 40 and 45 rpm. At these higher velocities, furthermore, the subjects essentially lost their sensation of being tilted off vertical. In the second half of the study, the effect of tilt angle was varied while the rotation rate was maintained at a constant 17.5 rpm. Two subjects were completely resistant to symptoms of motion sickness when rotated at 2.5 deg off vertical; with greater off-vertical angles, the susceptibility of all subjects increased sharply at first, then tapered off in a manner reflecting a Fechnerian function. Author

N74-18765* Toronto Univ. (Ontario).
BRAIN BLOOD-FLOW CHANGES DURING MOTION SICKNESS
Walter H. Johnson and John Hsuen *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 105-107 refs (For availability see N74-18754 10-04)
CSCL 06P

The possibility of diminished blood flow in the brain is studied as one of the factors resulting from an increase in skeletal muscle blood volume concomitant with other characteristics of motion sickness. Thermistors are implanted in the thalamus of dogs and blood flow changes are recorded while they are subjected to sinusoidal movement on a two pole swing. Results of these initial steps in a proposed long term exploration of different areas of the brain are presented. Author

N74-18766* Louisiana State Univ., Shreveport.
ANTI-MOTION-SICKNESS THERAPY
Charles D. Wood *In* NASA, Washinton Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 109-114 refs (For availability see N74-18754 10-04)
CSCL 06E

Neither alterations in environmental temperature nor moderate intake of alcohol was found to alter susceptibility to motion sickness in subjects exposed to rotation in the Pensacola slow rotation room. Scopolamine with d-amphetamine was found to be the most effective preparation for the prevention of motion sickness under the experimental conditions of the studies reported here. Promethazine in combination with d-amphetamine was in the same range of effectiveness. Drug actions suggest that acetylcholine and norepinephrine may be involved in motion sickness. Author

N74-18767* Naval Aerospace Medical Research Lab., Pensacola, Fla.
ARTIFACTS PRODUCED DURING ELECTRICAL STIMULATION OF THE VESTIBULAR NERVE IN CATS
Pei Chin Tang *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 115-123 refs (For availability see N74-18754 10-04)
CSCL 06C

Evidence is presented to indicate that evoked potentials in the recurrent laryngeal, the cervical sympathetic, and the phrenic

nerve, commonly reported as being elicited by vestibular nerve stimulation, may be due to stimulation of structures other than the vestibular nerve. Experiments carried out in decerebrated cats indicated that stimulation of the petrous bone and not that of the vestibular nerve is responsible for the genesis of evoked potentials in the recurrent laryngeal and the cervical sympathetic nerves. The phrenic response to electrical stimulation applied through bipolar straight electrodes appears to be the result of stimulation of the facial nerve in the facial canal by current spread along the petrous bone, since stimulation of the suspended facial nerve evoked potentials only in the phrenic nerve and not in the recurrent laryngeal nerve. These findings indicate that autonomic components of motion sickness represent the secondary reactions and not the primary responses to vestibular stimulation. Author

N74-18768* Defence Research Establishment Toronto, Downsview (Ontario).
THE VESTIBULAR SYSTEM OF THE OWL
K. E. Money and M. J. Correia *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 127-132 refs (For availability see N74-18754 10-04)
CSCL 06C

Five owls were given vestibular examinations, and two of them were sacrificed to provide serial histological sections of the temporal bones. The owls exhibited a curious variability in the postrotatory head nystagmus following abrupt deceleration; sometimes a brisk nystagnus with direction opposite to that appropriate to the stimulus would occur promptly after deceleration. It was found also that owls can exhibit a remarkable head stability during angular movement of the body about any axis passing through the skull. The vestibular apparatus in the owl is larger than in man, and a prominent crista neglecta is present. The tectorial membrane, the cupula, and the otolithic membranes of the utricle, saccule, and lagena are all attached to surfaces in addition to the surfaces hearing hair cells. These attachments are very substantial in the utricular otolithic membrane and in the cupula. Author

N74-18769* Stanford Univ., Palo Alto, Calif.
THE ROLE OF PERILYMPH IN THE RESPONSE OF THE SEMICIRCULAR CANALS TO ANGULAR ACCELERATION
Max Anliker and William VanBuskirk *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 135-141 refs (For availability see N74-18754 10-04)

A new model for the response of the semicircular canals to angular motion is postulated. This model is based on evidence that the bony canal is not compartmentalized and assumes that the ampulla wall is highly flexible. It is shown that the perilymph induces a cupula displacement far greater than that produced by the endolymph alone. The predicted dynamic behavior of the canals on the basis of this model is found to be consistent with experimental observations. Author

N74-18770* Illinois Univ., Urbana.
SCANNING ELECTRON MICROSCOPY OF THE VESTIBULAR END ORGANS
Henrik H. Lindeman, Harlow W. Ades, and Roger W. West *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 145-156 refs (For availability see N74-18754 10-04)
CSCL 06P

The vestibular end organs, after chemical fixation, were freeze dried, coated with gold and palladium, and studied in the scanning microscope. Scanning microscopy gives a good three dimensional view of the sensory areas and allows study of both gross anatomy and microstructures. Cross anatomical features of the structure of the ampullae are demonstrated. The form of the statoconia in different species of animals is shown. New aspects of the structure of the sensory hairs are revealed. The hair bundles in the central areas of the cristae and in the striola of the maculae differ structurally from the hair bundles at the periphery of the sensory regions. Furthermore, some hair bundles consisting of very short stereocilia were observed. The relationship between the cupula and the statoconial membrane to the epithelial surface is discussed. Author

N74-18771* Civil Aeromedical Inst., Oklahoma City, Okla.
HABITUATION OF VESTIBULAR RESPONSES: AN OVERVIEW
William E. Collins *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 157-193 refs (For availability see N74-18754 10-04)
CSCL 06P

An historical survey of vestibular habituation experiments has been undertaken. Methodological problems are presented briefly, and the influence of arousal on vestibular responses is detailed. Data obtained from animals and from man are treated separately. At least for man, the term habituation may be better defined by a dynamic change in the form of vestibular responses than by a simple response reduction. Author

N74-18772* Naval Aerospace Medical Research Lab., Pensacola, Fla.
OTOLITHIC INFLUENCES ON EXTRAOCULAR AND INTRAOCULAR MUSCLES
Bo E. Gernandt *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 195-201 refs (For availability see N74-18754 10-04)
CSCL 06P

Selective stimulation of utricular gravireceptors leads to gross activation of the bulbar reticular formation where a strong interaction with evoked spino-bulbo-spinal reflex activity occurs. The utricular neurons encountered by microelectrodes in the lateral vestibular nuclei show four types of elicited activity; two of these display an increased firing rate, and two exhibit pronounced inhibitory effects. Application of a stimulus of long duration and constant intensity to the utricle has shown that rapid adaptation of the peripheral receptors is a prominent feature. The effects of selective utricular stimulation upon eye movements, as recorded by the corneoretinal potential method, have been studied in experiments on cats and monkeys and it can be firmly stated that prolonged stimulation of the utricle can evoke strong primary nystagmus, followed by a secondary nystagmus at the cessation of stimulation. The action of utricular stimulation on ocular reflexes has been examined further, with particular attention to evoked pupillary reactions in both cats and monkeys: constriction during the fast phase of the brisk conjugate eye movement and dilatation during the flow phase. Author

N74-18773* Massachusetts Inst. of Tech., Cambridge.
ON VISUAL-VESTIBULAR INTERACTION
Laurence R. Young *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 205-210 refs (For availability see N74-18754 10-04)
CSCL 06P

Experimental evidence is presented regarding visual vestibular interaction, and the results of three studies on the subject are briefly noted. An attempt to put together some of these observations with elementary notions of a visual vestibular interaction program is shown in the form of a flow chart representation of a possible model. This is a nonlinear model in which visual and vestibular influences are linearly weighted when they are in relative agreement but switch to the more believable one when they are in disagreement. A solution to the human space orientation problem is depicted by a schema for optimal subjective orientation based on several sensory modalities. Author

N74-18774* Naval Aerospace Medical Research Lab., Pensacola, Fla.
SUBJECTIVE AND NYSTAGMUS REACTIONS CONSIDERED IN RELATION TO MODELS OF VESTIBULAR FUNCTION
F. E. Guedry, Jr., R. D. Gilson, and C. W. Stockwell *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 211-219 refs Sponsored in part by Army Aeromed. Res. Lab. and NASA (For availability see N74-18754 10-04)
CSCL 06P

Modelling will become increasingly important as more knowledge is accumulated, because it offers advantages in predicting reactions of individuals in a variety of situations, including novel aerospace environments, and in specifying a few parameters which should have considerable clinical significance.

However, the need for continuing experimental crosschecks of these models has been illustrated by several sets of results which would not have been predicted by any existing models. Author

N74-18775* Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
RESPONSES TO ROTATING LINEAR ACCELERATION VECTORS CONSIDERED IN RELATION TO A MODEL OF THE OTOLITH ORGANS
Alan J. Benson and Graham R. Barnes *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 221-236 refs (For availability see N74-18754 10-04)
CSCL 06S

Human subjects were exposed to a linear acceleration vector that rotated in the transverse plane of the skull without angular counterrotation. Lateral eye movements showed a sinusoidal change in slow phase velocity and an asymmetry or bias in the same direction as vector rotation. A model is developed that attributes the oculomotor response to otolithic mechanisms. It is suggested that the bias component is the manifestation of torsion of the statoconial plaque relative to the base of the utricular macula and that the sinusoidal component represents the translational oscillation of the statoconia. The model subsumes a hypothetical neural mechanism which allows x- and y-axis accelerations to be resolved. Derivation of equations of motion for the statoconial plaque in torsion and translation, which take into account forces acting in shear and normal to the macula, yield estimates of bias and sinusoidal components that are in qualitative agreement with the diverse experimental findings. Author

N74-18776* Politecnico di Milano (Italy). Lab. di Controlli Automatici.
SYSTEMS ANALYSIS OF THE VESTIBULO-OCULAR SYSTEM
Roberto M. Schmid *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 237-249 refs (For availability see N74-18754 10-04)
CSCL 06P

The vestibulo-ocular system is examined from the standpoint of system theory. The evolution of a mathematical model of the vestibulo-ocular system in an attempt to match more and more experimental data is followed step by step. The final model explains many characteristics of the eye movement in vestibularly induced nystagmus. The analysis of the dynamic behavior of the model at the different stages of its development is illustrated in time domain, mainly in a qualitative way. Author

N74-18777* Chicago Coll. of Osteopathic Medicine, Ill.
USE OF STEINHAUSEN'S MODEL FOR DESCRIBING PERIODIC CORIOLIS STAR NYSTAGMUS
Maximo Valentinuzzi *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 251-262 refs (For availability see N74-18754 10-04)
CSCL 06P

Phase lag, maximal slow phase velocity, and beat frequency were measured in periodic Coriolis star nystagmus. The results have been described by Steinhausen's model of the semicircular canal system. Estimates of the biophysical constants have been obtained. It is concluded that this model is a good functional approximation for describing, and also for interpreting, the behavior of the system. Author

N74-18778* Chicago Coll. of Osteopathic Medicine, Ill.
USE OF LORENTE DE NO'S NEURON CIRCUIT MODEL FOR DESCRIBING ACCELERATORY NYSTAGMUS
Maximo Valentinuzzi *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 263-272 refs (For availability see N74-18754 10-04)
CSCL 06P

Results of a previous metric analysis and an electronic simulation of acceleratory nystagmus are given. On this basis, a tentative mathematical model for describing acceleratory nystagmus is reported. The essential content of the model is Lorente de No's neuron circuit, to which the two-factor theory of excitation has been applied. Author

N74-18779# Advisory Group for Aerospace Research and Development, Paris (France).
CLINICAL PSYCHOLOGY AND PSYCHIATRY OF THE AEROSPACE OPERATIONAL ENVIRONMENT
P. J. OConnor, ed. (Roy. Air Force Central Med. Est.) Dec. 1973 68 p refs Presented at AGARD Aerospace Med. Panel Specialists Meeting, Soesterberg, Netherlands, 6 Sep. 1973 (AGARD-CP-133) Avail: NTIS HC $6.50

Stresses inherent in the military aircrew role are summarized. Summary data cover life stresses, relationship of domestic stress to operational efficiency, and motivation. Data are also given on structural anomalies of the brain and its effects on flying and phobic flight reaction. Several methods of treating psychiatric illness are included. For individual titles, see N74-18780 through N74-18791.

N74-18780 Gaustad Mental Hospital, Oslo (Norway). EEG Research Inst.
MENTAL AND PHYSIOLOGICAL ENVIRONMENTAL REQUIREMENTS IN MANNED FLIGHTS
C. W. Sem-Jacobsen *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 6 p refs (For availability see N74-18779 10-04)

A study was made of the training and maintenance of today's pilot with respect to his physiological and mental environment. Special attention was placed on a complete monitoring of pilots under operational conditions to map out his tolerance and requirements for full efficiency. E.H.W.

N74-18781 Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
FEAR OF FLYING AND ITS TREATMENT
K. Gerbert and H. Oberholz *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 6 p refs (For availability see N74-18779 10-04)

A clinical effort was made to treat and return to flying status, pilots in whom psychic, performance, and behavioral irregularities were cited. Particular attention was given to pilots with fear of flying. Treatment was based on quasi-therapeutic interviews, conflict centered counseling, physical exercise therapy, and individually directed flying rehabilitation programs. E.H.W.

N74-18782 Royal Air Force Central Medical Establishment, London (England).
RESULTS OF BEHAVIOUR THERAPY IN FLYING PHOBIA
P. J. OConnor, J. A. Lister, and J. W. Rollins *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 3 p (For availability see N74-18779 10-04)

The treatment of military crews and pilots for flying phobia by behavior therapy is discussed. Treatment was divided into three series. In series 1 seven cases were treated. Only men who were highly motivated towards military flying and possessed a robust personality were selected. Sixteen consecutive cases were treated in Series 2. No selection was made, all personnel diagnosed as having flying phobia were admitted for treatment. After evaluating the results it was decided to revert to treating select cases. Series 3 had eight cases. All men selected because they had good prognosis for recovery. It was concluded that there is a better chance of improving a pilot with flying phobia to the point where he can fly training type aircraft than for getting him well enough to return to high performance aircraft. Author

N74-18783 Royal Air Force, Farnborough (England).
ASSESSMENT OF BEHAVIOUR THERAPY IN THE TREATMENT OF FLYING PHOBIAS
A. B. Goorney *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 7 p refs (For availability see N74-18779 10-04)

An accurate assessment of the effectiveness of behaviour therapy (or of any other therapeutic method) in the treatment of flying phobias is difficult due to lack of information. Nevertheless there is evidence to suggest that for selected cases behaviour therapy may be an effective treatment with a high percentage returned to full flying. Selection should be restricted to cases in whom anxiety is limited to a part of the total flying environment (focal anxiety). A mixed technique is suggested in which emotional control is regained through non-reinforcement. Author

N74-18784 Royal Air Force Central Medical Establishment, London (England).

DEPRESSION IN AIRCREW

P. J. OConnor, A. W. Black, and J. W. Rollins *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 2 p (For availability see N74-18779 10-04)

Treatment and disposal of depressive illness in air crews are analyzed. Common etiological factors of the illness are listed. Author

N74-18785 Centre Medical de Psychologie Clinique de l'Armee de l'Air, Paris (France).

CLINICAL STUDY OF LOSS OF AERONAUTICAL MOTIVATION [ETUDE CLINIQUE DES PERTES DE MOTIVATION AERONAUTIQUE]

R. Gelly *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 4 p In FRENCH (For availability see N74-18779 10-04)

Factors accountable for the loss of motivation or interest in flying by military crew trainees are examined. Some of the motivation loss was attributed to: social and flight stress, expectations of trainee not met during training period, and psychological and psychiatric aptitude of trainee is exceeded by training. Transl. by E.H.W.

N74-18786 Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

PARTIAL CEREBRAL HYPOXIC ATTACKS IN PILOTS AS CAUSE OF HYPOXIA INCIDENTS

H. Oberholz *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 4 p refs (For availability see N74-18779 10-04)

Screening methods for detecting and avoiding as well as determining the causes of cerebral hypoxic attacks in pilots during flying missions are introduced. Special attention was given to anomalies and variants of brain arteries, especially the Circle of Willis as the possible source of the attacks. Two case histories along with symptoms of the attacks are outlined. It was concluded from the data that the Circle of Willis in combination with hypoxia, low G forces, mental stress, extreme heat, and any kind of exhaustive or vestibular stimuli cause cerebral attacks. E.H.W.

N74-18787 School of Aerospace Medicine, Brooks AFB, Tex. Neuropsychiatry Branch.

CHARACTERISTICS OF LIFE STRESS IN A POPULATION OF MILITARY AVIATORS

Carlos J. G. Perry and John W. Gaines *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 2 p (For availability see N74-18779 10-04)

A description is given of a military aviator population with respect to the occurence of life stress events in its individual members. Questionnaires, inventories, and checklists were deliberately avoided to emphasize a broad range of freedom for the interviewer. During the course of such an interview life stress events were discovered that are missed by questionnaires. This was especially true of anniversary stress which was revealed only through persistent, patient questioning. A total of 320 life stress events were found during the study. Job stress was most frequently represented with personal health, marital, and parental relationships following in order of frequency. Author

N74-18788 Centre de Medecine Aeronautique, Brussels (Belgium).

SELECTION OF STUDENT PILOT CANDIDATES OF THE BELGIAN AIR FORCE BY PSYCHOMOTOR TESTS [SELECTION DES CANDIDATS ELEVES-PILOTES DE LA FORCE AERIENNE BELGE PAR DES TESTS PSYCHO-MOTEURS] c05

J. Clement and J. Pardaens *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 11 p refs In FRENCH (For availability see N74-18779 10-04)

The predictive value of psychometric tests in investigating a sample of 413 student pilots and determining their fitness as future pilots is reported. The tests are used in conjunction with a linear method to select candidate student pilots. Results of the tests are given in tables and graphs. Transl. by E.H.W.

N74-18789 Centre de Medecine Aeronautique, Brussels (Belgium).

PERSONALITY TRAITS AND FLIGHT APTITUDE [TRAITS DE PERSONNALITE ET APTITUDE AU VOL]

VanMassenhove and Flion *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 8 p In FRENCH (For availability see N74-18779 10-04)

Szondi's psychological testing method was used to determine the fitness and flight aptitude of student pilots. In particular an attempt was made to determine personality traits and correlate them with flight aptitude. Seventy nine student pilots were tested using two groups designated as Group A and Group B. Group A students were just entering training and Group B students were ending their training. A comparison was made of the two Groups' response to different flight environments. Detailed results are given in graphs. Transl. by E.H.W.

N74-18790 Italian Air Force Aerospace Medical Center, Rome.

IN-FLIGHT PSYCHIC LOAD IN STUDENT-PILOTS, EVALUATED BY MEANS OF VANIL MANDELIC ACID (VMA) CHANGES IN URINARY EXCRETION

G. Paolucci and G. Blundo *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 2 p refs (For availability see N74-18779 10-04)

Sixty four air cadets were tested for in-flight psychic load and anxiety crises by vanil mandelic acid content in the urine. The tests were made in an effort to determine possible preexcisting stress and the measurement of its degree. It was suggested that VMA content is proportional to the amount of stress, and that this method should be included in tests for selecting pilots. Author

N74-18791 Royal Netherlands Air Force the Hague.

INFLUENCE OF SOCIAL/RELATIONAL FACTORS ON OPERATIONAL FLYING CAPACITY: A SYSTEM-ORIENTED APPROACH c05

H. Merkus and J. J. VanderMaas *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 5 p refs (For availability see N74-18779 10-04)

The effectiveness of the psycho-social approach to treating military pilots with psychological problems or symptoms of such problems is examined. After an explanation about the viewpoints of the psycho-social model, a description is given of how the model is made applicable in psychiatric practice. Three case histories are presented to illustrate the use of the model. Author

N74-18792# Bureau of Mines, Bartlesville, Okla. Energy Research Center.

HAZARD FROM ENGINES REBREATHING EXHAUST IN CONFINED SPACE

W. F. Marshall and R. W. Hurn 1973 20 p

(BM-RI-7757) Avail: NTIS HC $4.00

A series of experiments to determine the influence of exhaust rebreathing on emissions from various gasoline and diesel engines is reported. Tests were conducted that simulated operation of engines in nonventilated spaces as well as in spaces with partially restricted ventilation. Results of these tests show that exhaust rebreathing can have a marked effect on exhaust emissions and thus on the composition of the air in the working space. For the case of restricted ventilation, unacceptably high (greater than 50 ppm) levels of CO in the air of the working space resulted from exhaust rebreathing rates as low as 8 pct exhaust in the engine's intake. Operation in a nonventilated space resulted in highly critical CO levels (fatal in a few minutes) at times corresponding to 1 to 3 pounds of fuel consumed per 1,000 cu ft of space. Tests involving spaces of various sizes showed that volume of the air space per se is not important--the primary variable is fuel consumed per unit volume of air space. Author

N74-18793# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

INFORMATION THEORY OF NEURAL NOISE IN HEARING

R. E. Rink 1973 16 p refs Repr. from Mathematical Biosci., v. 16, 1973 p 129-142

(AF Proj. 7233)

(AD-760372; AMRL-TR-68-137) Avail: NTIS CSCL 05/10

The information capacity of the peripheral auditory system, as limited by the neural noise effect, is computed. The cochlear patterns are taken to be continuous space-time surfaces, with parameters of characteristics length and characteristic time as estimated form mechanical and synaptic transfer functions. The output messages are taken to be the sets of spike counts from small, optimally-dimensional subdivisions of the space-time domain on the auditory nerve. The computed upper and lower bounds on capacity are 5160 and 8500 bits/sec, respectively, in agreement with a previous determination which was based on psychoacoustic measurements of difference limen and masking distance. The agreement implies that the limitation on capicity is peripheral rather than central, and that the physiological phenomenon of neural noise accounts for the psychoacoustic phenomena of limited acuity of hearing. Author (GRA)

N74-18794# Army Edgewood Arsenal, Md.
INTERACTIVE EFFECTS OF HEAT LOAD AND RESPIRATORY STRESS ON WORK PERFORMANCE OF MEN WEARING CB PROTECTIVE EQUIPMENT Technical Report, Jun. 1971 - Nov. 1972
Arthur T. Johnson and Howard M. Berlin Dec. 1973 35 p refs
(DA Proj. 1W6-62710-A-095)
(AD-771931; ED-TR-73059) Avail: NTIS CSCL 06/19

Interaction between the effects of respiratory stress and thermal stress has been objectively identified. Analyses of data on distance run, percentage of inspiration at termination, and respiration rate at termination indicate the low value of resistance, 0.1 mm H2O-min/liter, to be the point at which interaction occurs. The heat load value causing interaction is somewhat equivocal. A model has been proposed which is consistent with our results and which defines the stress limitations for different rates of exercise. With the use of this model, the value of 0.1 mm H2O-min/liter has been objectively defined as the minimum effectual protective mask airflow resistance. Evidence is presented for exhalation time as the index of the respiratory stress limitation. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N74-18795*# Techtran Corp., Glen Burnie, Md.
PROBLEMS OF SPACE BIOLOGY. VOLUME 24. THE WATER SUPPLY OF SPACECRAFT CREWS
S. V. Chizhov and Yu. Ye. Sinyak Washington NASA Mar. 1974 262 p refs Transl. into ENGLISH of the book "Problemy Kosmicheskoy Biologii. Tom 24: Vodoobespecheniye Ekipazhey Kosmicheskikh Korabley" Moscow, Nauka, 1973 268 p
(Contract NASw-2485)
(NASA-TT-F-15164) Avail: NTIS HC $16.25 CSCL 06K

Some form of water recycling or regeneration will be required aboard spacecraft on planetary exploration missions. Various methods of recapturing water from moisture-containing products of human vital activity (feces, urine, sweat) and recycling water used for sanitary and hygienic purposes are examined. The use of ion-exchange resins and absorbent materials, as well as semipermeable membranes is discussed. The problems involved in decontaminating and deodorizing recycled water are examined in detail. Author

N74-18796*# Systems Control, Inc., Palo Alto, Calif.
A PREDICTIVE PILOT MODEL FOR STOL AIRCRAFT LANDING Final Report
David L. Kleinman and William R. Killingsworth Washington NASA Mar. 1974 130 p refs
(Contract NAS1-11727)
(NASA-CR-2374) Avail: NTIS HC $4.75 CSCL 05E

An optimal control approach has been used to model pilot performance during STOL flare and landing. The model is used to predict pilot landing performance for three STOL configurations, each having a different level of automatic control augmentation. Model predictions are compared with flight simulator data. It is concluded that the model can be effective design tool for studying analytically the effects of display modifications, different stability augmentation systems, and proposed changes in the landing area geometry. Author

N74-18797# Advisory Group for Aerospace Research and Development, Paris (France).
BEHAVIOURAL ASPECTS OF AIRCRAFT ACCIDENTS
K. G. G. Corkindale, ed. (Inst. of Aviation Med.) Dec. 1973 72 p refs Papers presented at AGARD Aerospace Med. Panel Specialists Meeting, Soesterberg, Netherlands, 7 Sep. 1973
(AGARD-CP-132) Avail: NTIS HC $6.75

A conference was conducted to discuss the influence of human factors on aircraft accidents. The subjects discussed were: (1) human factors approach to aircraft accident analysis, (2) human factor in cyclic aircraft accident patterns, (3) the application of aircrew opinions on cockpit tasks and equipment to flight safety research, and (4) the psychologists's role in aircraft accident investigation. The primary purpose of the conference was to determine if research projects in human factors engineering could result in a reduction in the pilot error accident rate. For individual titles, see N74-18798 through N74-18804.

N74-18798 Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
PILOT FACTOR IN AIRCRAFT ACCIDENTS OF THE GERMAN FEDERAL ARMED FORCES
B. Falckenberg *In* AGARD Behavioural Aspects of Aircraft Accidents Dec. 1973 7 p refs (For availability see N74-18797 10-05)

An analysis with reference to the most frequent types of pilot error was made of 154 aircraft accidents which occurred in the years between 1967 - 1970. Of special interest were differences between pilots of jet, propeller aircraft and helicopters. The flying experience of the pilot, his age and other so called time-variable factors were also taken into consideration. In general, errors predominantly occurred during low level flight and during the landing phase immediately before touch-down. In jet aircraft accidents the majority of errors committed by the pilot is due to an extreme workload in handling his aircraft. In pilots of the other categories, particularly on propeller-driven aircraft, those types of errors are more pronounced which may be attributed to the pilot's flying attitude (in extreme cases resulting in violations). The findings of other authors relating to flying experience could be confirmed. As for the age distribution of pilots there were remarkable differences in comparison with the data in other publications. Author

N74-18799 Naval Aerospace Medical Research Lab., Pensacola, Fla.
HUMAN FACTORS APPROACH TO AIRCRAFT ACCIDENT ANALYSIS
Richard H. Shannon and Wayne L. Waag *In* AGARD Behavioural Aspects of Aircraft Accidents Dec. 1973 10 p refs (For availability see N74-18797 10-05)

Naval accident reports involving the P-3 and F-4 aircraft were examined over seven and five year periods, respectively. The critical incident technique was used to catalogue, describe, and analyze operational flight crew errors in both aircraft. An in-depth study was performed in order to identify those problems which were common as well as specific to both aircraft. The P-3 and F-4 aircraft were selected because of their completely different fleet missions and handling characteristics. Human errors were categorized according to three types: (1) vigilance errors; (2) procedural errors; and (3) perceptual motor errors. Phases of flight operation were divided into four segments: (1) servicing/preflight/postflight; (2) start/taxi/shutdown; (3) takeoff/landing; and (4) inflight. Four remedial areas were outlined for reducing human error: (1) crew coordination; (2) design; (3) discipline; and (4) training. From the F-4 accident reports, 437 human errors were isolated while the P-3 reports contained 345 errors. Twenty-eight major error categories emerged from the analysis of these errors. The accident reports were further analyzed for the errors which both aircraft had in common. Twenty common error groups were found to occur in the P-3 and the F-4, representing 22.9% and 18.8% of the total errors, respectively. The flight segment of takeoff/landing, and, the error type of

procedures, shared the most commonality across the two aircraft. Author

N74-18800 Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
THE HUMAN FACTOR IN CYCLIC AIRCRAFT ACCIDENT PATTERNS
Peter J. Dean *In* AGARD Behavioural Aspects of Aircraft Accidents Dec. 1973 8 p refs (For availability see N74-18797 10-05)

An analysis of the human factors in aircraft accidents was conducted to isolate cyclic human factors which cause the accidents. The operational record of the CF-104 aircraft was used for the analysis. It was determined that the accidents tend to occur more frequently in January, April, July, and October than in the other months. The subjects discussed are: (1) the nature of the cyclic phenomena and how they influence man, (2) previous studies of cyclic patterns in aircraft accidents, and (3) specific cyclic factors related to aircraft accidents and recommendations for preventing aircraft accidents. Author

N74-18801 Bunker-Ramo Corp., Westlake Village, Calif.
EVALUATION OF THE ROLE OF THE SIMULATOR IN TRAINING AIRBORNE ASW OPERATIONS c11
James E. Robins, Dorothy L. Finley, and Thomas G. Ryan *In* AGARD Behavioural Aspects of Aircraft Accident Dec. 1973 8 p Sponsored by Naval Training Equipment Center (For availability see N74-18797 10-05)

The effectiveness of the U.S. Navy device 2F69B, a weapons trainer for the P3A and P3B aircraft was investigated. The device provides tactics crews with team training in the detection, tracking, and destruction of modern deep diving submarines. Careful selection, variation and control of problem conditions should enable instructors to train the tactics teams to analyze and respond to situations likely to occur during actual ASW missions. Study results indicate that learning takes place in the simulator and that there is positive transfer to the operational environment. There is room for improvement and modification of the training curriculum. Author

N74-18802 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
THE APPLICATION OF AIRCREW OPINIONS ON COCKPIT TASKS AND EQUIPMENT TO FLIGHT SAFETY RESEARCH
J. M. Rolfe and J. W. Chappelow *In* AGARD Behavioural Aspects of Aircraft Accidents Dec. 1973 5 p ref (For availability see N74-18797 10-05)

A study was conducted to determine the impact of flight crew opinions on flight tasks and aircraft equipment on aircraft accidents which could be related to personnel error. The areas of investigation were: (1) the load imposed on the flight crew in the performance of their duties and (2) the compatibility between the aircraft equipment and the human limitations and abilities. Tables of data are provided to show the results of a questionnaire submitted to flight crew personnel. Author

N74-18803 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
THE PSYCHOLOGIST'S ROLE IN AIRCRAFT ACCIDENT INVESTIGATION
M. F. Allnut *In* AGARD Behavioural Aspects of Aircraft Accidents Dec. 1973 6 p (For availability see N74-18797 10-05)

The contributions to be made by psychologists in the reduction of human error aircraft accidents are discussed. Specific areas of cooperation are identified as: (1) analysis of human error accident data, (2) research on human factor aspects of flight safety, and (3) assist in determining the causes of specific aircraft accidents. The advantages of using psychologists in the aircraft accident investigation are reported. Author

N74-18804 Army Agency for Aviation Safety, Fort Rucker, Ala.
INCIDENCE, COST AND FACTOR ANALYSIS OF PILOT-ERROR ACCIDENTS IN US ARMY AVIATION
Darwin S. Ricketson, Scott A. Johnson, Larry B. Branham, and Richard K. Dean *In* AGARD Behavioural Aspects of Aircraft Accidents Dec. 1973 19 p refs (For availability see N74-18797 10-05)

From 1959 through 1972 pilot-error was a consistently large and costly cause of accidents. Past analytic and prevention efforts have not approached pilot-error accidents in the context of malfunctions among the basic man-machine-environment elements. Such an approach was proposed and seeks to identify the common human-error events in pilot-error accidents. A partial test of this approach was made with helicopter and airplane mishap information in its present form. A factor analysis produced nine distinct, meaningful and representative helicopter and airplane factors. A component score analysis yielded pilot and mishap background information which was helpful in interpreting the factors. An experimental human-error events reporting form was developed which holds promise for clearer identification of mishap-causing system elements and corrective measures required. Author

N74-18805*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHOULDER HARNESS AND LAP BELT RESTRAINT SYSTEM Patent Application
Albert P. Garavaglia and Dennis S. Matsuhiro, inventors (to NASA) Filed 19 Mar. 1974 9 p
(NASA-Case-ARC-10519-2; US-Patent-Appl-SN-452767) Avail: NTIS HC $4.00 CSCL 06Q

A shoulder harness and lap belt restraint system are reported wherein the lap belt is combined with the shoulder harness in such a manner that a single fastening suffices to fasten both the shoulder strap and the lap belt. NASA

N74-18806# Politecnico di Torino (Italy). Ist. di Meccanica Applicata.
ARTIFICAL VOLUMETRIC RESPIRATOR WITH PROGRAMMABLE CYCLE [RESPIRATORE ARTIFICIALE VOLUMETRICO A CICLO PROGRAMMABILE]
G. Belforte Jun. 1972 20 p refs In ITALIAN Presented at 1st Convegno Mostra di Bioingegneria, Milan, 19-24 Jun. 1972 (Rept-608) Avail: NTIS HC $4.00

An artificial respirator is described which is either completely automatic, or assists the patient in breathing, on command from the patient. The command is obtained with a fluid circuit which assures a stable and safe operation. The construction of a prototype respirator is described, and the auxiliary and safety systems are analyzed. Transl. by F.O.S.

N74-18807# Advisory Group for Aerospace Research and Development, Paris (France).
MATHEMATICAL MODELS OF HUMAN PILOT BEHAVIOR
Duane T. McRuer (Systems Technol, Inc., (Hawthorne, Calif.) and E. S. Krendel (Pa. Univ.) Jan. 1974 83 p refs
(AGARD-AG-188; AGARDograph-188) Avail: NTIS HC $7.25

Mathematical models of the human pilot are used for analyses of the pilot/vehicle system. Elementary concepts and specific physical examples are used for a step-by-step development of what is known about the human pilot as a dynamic control component. In the process, quasi-linear models for single-loop systems with visual stimuli and multiloop systems with visual stimuli are presented and then extended to cover multiloop, multi-modality situations. Empirical connections between the pilot dynamics and pilot ratings are also considered. Nonlinear features of human pilot behavior in adapting to changes in the character of the stimuli are described and tied to the quasi-linear models via the successive organization of perception (SOP) theory, which is reviewed and elaborated. Dual-mode control models needed to describe the pilot's behavior in response to sudden transients are presented, along with pursuit and compensatory elements of the SOP continuum. The current status of mathematical pilot models is shown to cover random, random-appearing, and transient inputs for single- and multi-loop system configurations. A bibliograhy of applications and a summary of analysis problems is included. Author

N74-18749 Joint Publications Research Service, Arlington, Va.
EXPERIMENT WITH AN ARTIFICIAL BIOSPHERE DESCRIBED
B. Konovalov *In its* Horizons in Space Biol. and Med. (JPRS-61600) 28 Mar. 1974 p 14-19 Transl. into ENGLISH from

Izvestiya (Moscow), 27 Oct. 1973 p 5 (For availability see N74-18745 10-04)

N74-18756* National Aeronautics and Space Administration, Washington, D.C.
FINDINGS ON AMERICAN ASTRONAUTS BEARING ON THE ISSUE OF ARTIFICIAL GRAVITY FOR FUTURE MANNED SPACE VEHICLES
Charles A. Berry *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 15-22 refs (For availability see N74-18754 10-04)
CSCL 06S

N74-18757* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN OVERVIEW OF ARTIFICIAL GRAVITY
Ralph W. Stone, Jr. *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 23-33 refs (For availability see N74-18754 10-04)
CSCL 05E

N74-18760* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN OF EXPERIMENTAL STUDIES OF HUMAN PERFORMANCE UNDER INFLUENCES OF SIMULATED ARTIFICIAL GRAVITY
William M. Piland, H. George Hausch, Grady V. Maraman, and James A. Green (North Am. Rockwell Corp.) *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 55-65 refs (For availability see N74-18754 10-04)
CSCL 05E

N74-18761* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOCOMOTION IN A ROTATING ENVIRONMENT
William Letko *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 67-72 refs (For availability see N74-18754 10-04)
CSCL 05E

N74-18762* Naval Aerospace Medical Research Lab., Pensacola, Fla.
SOME PHYSIOLOGICAL ASPECTS OF ARTIFICIAL GRAVITY
D. B. Cramer and Ashton Graybiel *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 73-83 refs (For availability see N74-18754 10-04)
CSCL 05E

N74-18763* Leicester Univ. (England).
EFFECTS OF VISUAL REFERENCE ON ADAPTATION TO MOTION SICKNESS AND SUBJECTIVE RESPONSES EVOKED BY GRADED CROSS-COUPLED ANGULAR ACCELERATIONS
James T. Reason and Elgin Diaz *In* NASA, Washington Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 87-97 refs (For availability see N74-18754 10-04)
CSCL 05E

N74-18788 Centre de Medecine Aeronautique, Brussels (Belgium).
SELECTION OF STUDENT PILOT CANDIDATES OF THE BELGIAN AIR FORCE BY PSYCHOMOTOR TESTS [SELECTION DES CANDIDATS ELEVES-PILOTES DE LA FORCE AERIENNE BELGE PAR DES TESTS PSYCHO-MOTEURS]
J. Clement and J. Pardaens *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 11 p refs In FRENCH (For availability see N74-18779 10-04)

N74-18791 Royal Netherlands Air Force the Hague.
INFLUENCE OF SOCIAL/RELATIONAL FACTORS ON OPERATIONAL FLYING CAPACITY: A SYSTEM-ORIENTED APPROACH
H. Merkus and J. J. VanderMaas *In* AGARD Clin. Psychol. and Psychiat. of the Aerospace Operational Environ. Dec. 1973 5 p refs (For availability see N74-18779 10-04)

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N74-18808 Washington Univ., Seattle.
SOME THEORETICAL PROBLEMS CONCERNING ADSORBED HELIUM MONOLAYERS ON GRAPHITE Ph.D. Thesis
Robert Leon Siddon 1973 263 p
Avail: Univ. Microfilms Order No. 74-837

Two models of an adsorbed system: (1) an interacting two-dimensional gas, and (2) a quantum lattice gas are reported. The interacting gas is treated by means of a two-dimensional virial expansion. Second virial coefficients for helium are calculated from .1K to 60K for two cases: (1) a hard core interaction, and (2) a Lennard-Jones (6-12) interaction. The results of the calculation are applied to submonolayer films of helium adsorbed on graphite. The quantum lattice good is studied to determine the importance of quantum-mechanical processes upon order-disorder transitions. Systems with nearest neighbor attractive or repulsive interactions are treated within the Bethe-Peierls approximation. It is found that the calculation provides a qualitative explanation of the fact that He3 orders at a higher temperature than He4. Dissert. Abstr.

N74-18809 Virginia Univ., Charlottesville.
AN EXPERIMENTAL INVESTIGATION OF THE SCATTERING OF HELIUM ATOMS BY LiF AND NaCl CRYSTALS Ph.D. Thesis
James Ronald Bledsoe 1972 149 p
Avail: Univ. Microfilms Order No. 73-31118

Thermal energy He-4 atoms are scattered from the (001) surface of LiF and the (001) surface of NaCl to better define the character of elastic and nonreactive inelastic gas-surface interaction processes in which quantum effects are resolvable. An aerodynamic (nozzle-type) molecular beam and a time-of-flight detection mechanism are utilized to measure the scattered atom flux and velocity distributions within the plane of incidence. These measurements are obtained parametrically as functions of beam-target orientation, incident beam energy (0.058-0.143eV), and surface temperature (300-500 K). Surface diffraction, selective adsorption, and energy exchange between gas and solid are observed and interpreted. Diffraction peaks of order as high as three are resolved for incidence along (100) and (110) crystallographic directions; their locations agree well with those predicted by simple theory. Dissert. Abstr.

N74-18810*# Rice Univ., Houston, Tex.
RESEARCH ON MATERIALS FOR ADVANCED ELECTRONIC AND AEROSPACE APPLICATION Semiannual Status Report, 1 Jan. - 30 Jun. 1973
30 Jun. 1973 29 p refs
(Grant NGR-44-006-001)
(NASA-CR-137234; SASR-28) Avail: NTIS HC $4.50 CSCL 07D

Research data are reported on optical and magnetic data processing, hydrogen in metals and stress corrosion phenomena, and polymers and materials at high temperatures and pressures. E.H.W.

N74-18811*# Boeing Co., New Orleans, La. Saturn/Apollo/Skylab Div.
INVESTIGATION INTO REVERSION OF POLYURETHANE ENCAPSULANTS
Carlos R. Lynch 8 Mar. 1973 30 p refs
(Contract NAS8-5608)
(NASA-CR-124231; T5-6917-8) Avail: NTIS HC $4.50 CSCL 07D

The effect of high humidity (95% RH) at 60 C, 70 C, 85 C and 100 C on the solid-to-liquid reversion of polyurethane elastomers (used for potting electrical connectors and conformal coating printed circuit boards) was investigated. Hardness measurements were conducted on eleven elastomers to track reversion for a 101-day period. The primary purpose of the tests was to provide data to predict service life for the polyurethane

elastomers. This was not accomplished as the hardness did not deteriorate rapidly enough at the lower test temperatures. The tests did determine that the potting and coating materials most widely used on the S-1C Program are susceptible to reversion but appear adequate for service in the S-1C environment.
Author

N74-18812*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERLABORATORY COMPARISON OF CHEMICAL ANALYSIS OF URANIUM MONONITRIDE
Emery J. Merkle, Warren F. Davis, John T. Halloran, and Judson W. Graab Washington Mar. 1974 23 p refs
(NASA-TN-D-7536; E-7674) Avail: NTIS HC $3.00 CSCL 07B

Analytical methods were established in which the critical variables were controlled, with the result that acceptable interlaboratory agreement was demonstrated for the chemical analysis of uranium mononitride. This was accomplished by using equipment readily available to laboratories performing metallurgical analyses. Agreement among three laboratories was shown to be very good for uranium and nitrogen. Interlaboratory precision of + or - 0.04 percent was achieved for both of these elements. Oxygen was determined to + or - 15 parts per million (ppm) at the 170-ppm level. The carbon determination gave an interlaboratory precision of + or - 46 ppm at the 320-ppm level.
Author

N74-18813# Lockheed-California Co., Burbank. Materials Lab.
GALVANIC CORROSION EFFECTS ASSOCIATED WITH GRAPHITE COMPOSITES/METAL JOINTS
G. R. Johnston, J. S. Fritzen, and K. E. Weber Nov. 1973 32 p refs
(LR-26088; Rept-21-3744-4228) Avail: NTIS HC $4.75

The corrosion reactions that occur when graphite composites are joined to aircraft structural metals have been investigated. The fundamental electrochemical mechanisms responsible for the galvanic degradation process were elucidated. Investigations were also performed to characterize the corrosion behavior of actual composite-to-metal joints subjected to salt spray environments. In addition, studies of the moisture permeability characteristics of graphite composites are in progress. Details of these various investigations and the experimental results obtained to date are presented.
Author

N74-18814# Notre Dame Univ., Ind. Radiation Chemistry Data Center.
RADIATION CHEMISTRY OF NITROUS OXIDE GAS: PRIMARY PROCESSES, ELEMENTARY REACTIONS, AND YIELDS Final Report
G. R. A. Johnson (Newcastle-upon-Tyne Univ.) Washington, D. C. Dec. 1973 29 p refs
(NSRDS-NBS-45; LC-72-600244) Avail: SOD HC $0.60 as C13.48:45

Data on the readiation yields from nitrous oxide gas, and the effects of variables, including dose-rate, total dose, pressure, temperature, applied fields and scavengers are reviewed and tabulated. The use of N2O as a gasphase, chemical dosimeter is discussed. Primary processes in irradiated N2O are discussed and elementary reactions, relevant to the system, are listed.
Author

N74-18815# Bureau of Mines, Washington, D.C.
ENERGY POTENTIAL FROM ORGANIC WASTES: A REVIEW OF THE QUANTITIES AND SOURCES
Larry L. Anderson 1972 19 p refs
(BM-IC-8549) Avail: SOD HC $.30

The quantities and sources of moisture- and ash-free organic material contained in manure, urban refuse, industrial wastes, sewage solids, and agricultural wastes in the United States are itemized and evaluated. Furthermore, estimates are presented for amounts of organic wastes collected or concentrated. The potential for fuel, either oil or gas, from both the total organic wastes generated and those collected or concentrated is also estimated.
Author

N74-18816# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
CORRELATIONS OF PHASE-BOUNDARY PRESSURES OF CONDENSATE FLUID SYSTEMS WITH COMPOSITIONS MODIFIED BY ADDED BUTANE
Byron A. Baker and C. Kenneth Eilerts 1973 62 p refs
(BM-RI-7759) Avail: NTIS HC $6.25

A windowed cell was used to measure the phase-boundary pressures of two related series of gas-condensate fluid mixtures. Normal butane was added to the mixtures incrementally to determine its effectiveness for lowering phase-boundary pressure. All the experimental data were correlated, so that the pressure required to maintain light oils mixed with natural gas in the single phase may be computed for secondary recovery applications. The heavy hydrocarbon parts of the mixtures were distillation fractions of Gulf Coast condensate. Intermediate normal hydrocarbons in the butane-heptane range and natural gas were added to the fractions in selected proportions, so that phase diagram pressure of 26 fluids were actually studied. The experimental range of temperatures was 50 to 280 F. Two correlations were developed to represent phase boundary pressures by means of a polynomial. Independent variables represent natural gas content, disparity of properties of components comprising the mixtures, and temperature. A fourth variable, for one correlation only, was the quantity of normal butane added to the original mixtures.
Author

N74-18817*# Wisconsin Univ., Madison. Inst. for Environmental Studies.
WATER QUALITY DETERMINATION BY PHOTOGRAPHIC ANALYSIS
Steven A. Klooster and James P. Scherz Aug. 1973 16 p refs Submitted for publication
(Grant NGL-50-002-127)
(NASA-CR-137306; Rept-21) Avail: NTIS HC $4.00 CSCL 07D

Aerial reconnaissance techniques to extract water quality parameters from aerial photos are reported. The turbidity can be correlated with total suspended solids if the constituent parts of the effluent remain the same and the volumetric flow remains relatively constant. A monochromator is used for the selection of the bandwidths containing the most information. White reflectance panels are used to locate sampling points and eliminate inherent energy changes from lens flare, radial lens fall-off, and changing subject illumination. Misleading information resulting from bottom effects is avoided by the use of Secchi disc readings and proper choice of wavelength for analyzing the photos.
Author

N74-18818# Oak Ridge National Lab., Tenn. Reactor Chemistry Div.
CORROSION STUDIES. THE CORROSION OF COPPER AND COPPER ALLOYS IN HIGH TEMPERATURE SODIUM CHLORIDE SOLUTIONS Final Report, 15 Mar. 1966 - 31 Oct. 1972
J. C. Griess, Jr., A. L. Bacarella, and E. G. Bohlmann Oct. 1973 138 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4340) Avail: NTIS HC $9.00

Results obtained during the last six years in a study aimed at evaluating the effects of selected impurities in saline waters on the corrosion of copper and copper alloys are summarized. Although funding of this program was terminated with many questions outstanding, much useful and significant information about the behavior of copper and copper alloys, and to a lesser extent nickel, in sodium chloride solutions at temperatures as high as 200 C were developed and are presented.
NSA

N74-18819# Kernforschungszentrum, Karlsruhe (West Germany). Lab. fuer Isotopentechnik.
ACTIVATION ANALYSIS. PROCEEDINGS OF THE THIRD SEMINAR
H. Vogg, ed. Aug. 1973 57 p In GERMAN; ENGLISH summary Conf. held at Karlsruhe, West Germany, 30-31 May 1972
(BMFT-FBK-73-23; Conf-7205100(Absts)) Avail: AEC Depository Libraries HC $5.00

Summaries from a seminar dealing exclusively with reactor activations are presented. The four main topics treated were: (a) practical aspects of neutron activation analysis, including its applications in industry, (b) neutron activation analysis in geology,

geochemistry, and cosmochemistry, (c) neutron activation analysis in biological systems and (d) computer controlled evaluations of gamma spectra. Author (NSA)

N74-18820# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THE NATURE OF THE ROTATIONAL STRUCTURE OF THE ALUMINUM OXIDATION SPECTRUM
L. V. Zhdanova 11 Dec. 1973 9 p refs Transl. into ENGLISH from Izv. Politekh. Inst. (Tomsk), v. 162, 1967 p 177-179
(FTD Proj. T74-05-14)
(AD-771887; FTD-HT-23-569-74) Avail: NTIS CSCL 07/4
The rotational structure of the AlO molecule in the spectrum of an aluminum flame, burning in oxygen, was investigated. GRA

N74-18821# California Univ., Berkeley. Dept. of Chemistry.
PREPARATION OF REACTIVE MOLECULES USING THE MATRIX ISOLATION AND FLASH PHOTOLYSIS TECHNIQUES Annual Report, 31 Oct. 1972 - 31 Oct. 1973
George C. Pimentel Oct. 1973 7 p
(Contract N00014-69-A-0300-1025; NR Proj. 093-041)
(AD-771727) Avail: NTIS CSCL 07/4
Developments in rapid scan spectroscopy and matrix isolation are briefly reviewed with regard to CH3 and CD3 radicals, and lithium bonding. GRA

N74-18822# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FUEL-RICH MAGNESIUM/OXIDIZER MIXES AS DRAG REDUCING FUMERS
J. Richard Ward and Richard K. Pahel Oct. 1973 24 p refs
(AD-771171/6GA; BRL-MR-2336) Avail: NTIS HC$2.75 CSCL 07/4
The Army is seeking increased ammunition effectiveness by reduction of projectile base drag. Evidence is presented that the excess magnesium in fuel-rich magnesium/oxidizer mixes vaporizes and burns with air indicating that these materials are attractive fumer candidates. (Modified author abstract) GRA

N74-18823# Tyco Labs., Inc., Waltham, Mass.
LOW TEMPERATURE ELECTROCHEMICAL SYSTEMS Final Report
Paul A. Malachesky and Kathleen Cahill Dec. 1973 156 p refs
(Contract DAAB07-71-C-0291)
(AD-773053; ECOM-0291-F) Avail: NTIS CSCL 10/3
The report describes research on the low temperature behavior of air electrodes for metal-air battery systems, specifically zinc-air cells. The studied influences on cathode performance include kinetics (via measurement of exchange currents, Tafel parameters, heats of activation for O2 reduction) and mass electrode transport factors (via electrolyte variations and electrode structure effects). An improved zinc-air cell evaluated. GRA

N74-18824# Sussex Univ., Brighton (England). School of Molecular Sciences.
COMPUTER ANALYSIS OF THERMOCHEMICAL DATA Final Report, Oct. 1969 - Dec. 1971
J. B. Pedley May 1972 44 p refs
(OSTI-5123) Avail: British Library Lending Div., Boston Spa, Engl.
Computer evaluated standard enthalpy of formation data for nitrogen compounds are presented in table form. G.G.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N74-18825 Colorado Univ., Boulder.
ELECTROMAGNETIC SCALE MODEL STUDY OF GEOPHYSICAL METHODS USING A PLANE WAVE SOURCE Ph.D. Thesis
Frank Conrad Frischknecht 1973 210 p
Avail: Univ. Microfilms Order No. 73-32534
A scale model facility was developed for the study of methods which employ distant sources of VLF and ELF energy. Measurements made over the brine tank in the absence of inhomogeneities showed that the surface impedance was the same as would be measured for an incident plane wave. However, the horizontal electric field falls off rather rapidly with height above the tank. Results of measurements made over a variety of cylinders, a sphere, and a dike are included. For long conducting cylinders, placed with their axes parallel to the normal horizontal electric field, flow of currents from the medium through the cylinder is the dominant phenomenon; eddy currents circulating only in the cylinder are rather unimportant in this case. Complicated variations on the response occur as the length depth beneath the surface, and conductivity of the cylinders is varied. Dissert. Abstr.

N74-18826+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
NOTE ON SOLAR PLASMA IRREGULARITIES AND PLASMA INSTABILITIES
S. K. Alurkar May 1972 10 p refs
(Proj. RASA 2)
(INPE-204-RI/005) Avail: NTIS HC $4.00
Observations of interplanetary scintillation of radio sources are used to estimate the size of plasma irregularities down to a distance of about 6 solar radii from the sun. This is compared with the values of the ion gyro-radius estimated for a range of distance from 1 a.u. to about 6 solar radii from the sun. The results of the calculations are discussed in the context of the hypothesis of plasma instability which is invoked to interpret the observations of the scattering of radio waves in the solar corona and of interplanetary scintillations. Author

N74-18827 British Broadcasting Corp., Kingswood (England). Research Dept.
THE If AND mf PROPAGATION: SKY-WAVE FIELD-STRENGTH PREDICTION
P. Knight Jan. 1974 10 p refs
(BBC-RD-1974/3) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England
During the night, medium frequency sky waves propagate to great distances via the ionosphere. The various factors which affect the waves as they travel from transmitter to receiver are described. Several methods which can be used for estimating the strength of sky wave signals are compared. Author

N74-18828*# Ohio State Univ., Columbus. ElectroScience Lab.
SINUSOIDAL REACTION FORMULATION FOR RADIATION AND SCATTERING FROM CONDUCTING SURFACES
J. H. Richmond and N. Wang Jan. 1974 36 p refs
(Grant NGL-36-008-138)
(NASA-CR-137302; ESL-2902-11) Avail: NTIS HC$5.00 CSCL 17B
A piecewise-sinusoidal reaction technique is developed for scattering and radiation from perfectly conducting bodies of arbitrary shape. The theory and numerical results for scattering patterns of rectangular plates and radiation patterns of corner-reflector antennas are presented. Experimental measurements are included for comparison with the calculated data. Author

N74-18829# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
STATISTICAL SENSITIVITY OF THE AVERAGE BACKSCATTERING CROSS SECTIONS FOR NORMALLY DISTRIBUTED ROUGH SURFACE MODELS
R. Larsen Jan. 1974 49 p refs
(RM-583) Avail: NTIS HC $5.50
Statistical sensitivity formulas are derived for the average incoherent radar return from two dimensional, normally distributed rough surface models with Gaussian correlation. The variations in the normalized cross sections are obtained by perturbing slightly the rms surface height and correlation length of the small scale roughness profile, and the total mean square surface slope of the large scale component. The resulting sensitivity expressions are then applied to an ocean surface model characterized

electrically by the complex permittivity of seawater at 10 GHz. By superposing the results obtained for the large scale and small scale roughness components, a reasonable estimate is made of the statistical sensitivity of the radar return from a composite ocean surface. Author

N74-18830# Communications Research Centre, Ottawa (Ontario). Communications Systems Directorate.
THE PLANNING OF DOMESTIC COMMUNICATION NETWORKS
G. A. Neufeld, R. R. Bowen, and A. R. Kaye Jan. 1974 18 p refs
(CRC-TN-663) Avail: NTIS HC $4.00

Techniques for the synthesis of domestic long haul communication systems to meet forecast traffic requirements must provide for cost effective integration of satellites with existing and new terrestrial systems. A methodology that may be used to carry out this synthesis is described. One of its important features is the separate investigation of the characteristics of satellite and terrestrial systems with merging of the results towards the end of the study. Optimization algorithms are described which are of general interest in that they can be used to optimize any network having step-like link costs. Author

N74-18831# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE SACI PROJECT AND THE EDUCATIONAL EXPERIMENT OF RIO GRANDE DO NORTE
Amancio Fernandes Pulcherio Jun. 1973 34 p refs Presented at Meeting "Sci. and Man in the Americans", Mexico, Jun. 1973
(INPE-344-RI/119) Avail: NTIS HC $4.75

The feasibility of using a satellite to broadcast educational television and radio programs to any points in Brazil is discussed. Preliminary analysis of first results from the State of Rio Grande do Norte indicates good receptiveness for upgrading teachers training; more or less difficult word use increased and is judged helpful in oral presentation. The most difficult programs for students are Portuguese and physical education. G.G.

N74-18832*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SIMULATION STUDY OF COMMUNICATION LINK FOR PIONEER SATURN/URANUS ATMOSPHERIC ENTRY PROBE
Carl A. Hinrichs Washington NASA Mar. 1974 214 p refs (Contract NAS2-7935)
(NASA-CR-114739) Avail: NTIS HC $13.75 CSCL 22B

A digital simulation is presented for a candidate modem in a modeled atmospheric scintillation environment with Doppler, Doppler rate, and signal attenuation typical of the radio link conditions for an outer planets atmospheric entry probe. The results indicate that the signal acquisition characteristics and the channel error rate are acceptable for the system requirements of the radio link. The simulation also outputs data for calculating other error statistics and a quantized symbol stream from which error correction decoding can be analyzed. Author

N74-18833# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD FLIGHT TEST INSTRUMENTATION SERIES. VOLUME 5: MAGNETIC RECORDING OF FLIGHT TEST DATA
G. E. Bennett, W. D. Mace, ed., and A. Pool, ed. Feb. 1974 80 p refs
(AGARDograph-160-Vol-5; AGARD-AG-160-Vol-5) Avail: NTIS HC $7.00

An assessment of the general requirement for a flight test data acquisition system is followed with a general discussion of the complete system. The more important individual functions of the system are those most intimately involved in determining the performance of the system and its efficiency in acquiring the data. In the case of the recording aspects emphasis is placed on the basic recording process, its capabilities and its problems, and on the techniques necessary to overcome its shortcomings. Basic design principles of airborne tape transports and the characteristics of write/read heads and magnetic tape are also discussed. Author

N74-18834# Atlantic Research Corp., Alexandria, Va. Advanced Programs Group.
METHODS OF MOMENTS APPLICATIONS. VOLUME 3: THIN WIRE ANALYSIS PROGRAM (TWAP) USER MANUAL Final Technical Report, Jun. 1971 - Jan. 1973
Thomas E. Baldwin, Jr. Oct. 1973 178 p refs
(Contract F30602-71-C-0358; AF Proj. 4540)
(AD-771551; RADC-TR-73-217-Vol-3) Avail: NTIS CSCL 09/5

The primary objective of the User Manual is to provide the antenna analyst with a detailed description of and operating instructions for the automated analysis process for evaluating the interactions between wire antennas and arrays of wire antennas of arbitrary orientation. Information contained in the TWAP User Manual includes a general discussion of the Thin Wire Analysis Process, computer program running procedures, a detailed program description, and sample problems. There are several major subprograms associated with the TWAP which are implemented via an executive or main program. Each of the major programs are presented with the same standard format. This format consists of (1) General, (2) Models and Techniques, and (3) Input/Output. (Modified author abstract) GRA

N74-18835# Army Foreign Science and Technology Center, Charlottesville, Va.
INTRODUCTION TO RADAR SYSTEMS ENGINEERING
D. Kontorov and Yu. S. Golubev-Novoshilov 12 Jul. 1973 401 p refs Transl. into ENGLISH of the book "Vvedeniye v Radiolokatsionnuyu Sistemotekhniku" Moscow, Sov. Radio, 1971 367 p
(AD-771077; FSTC-HT-23-242-73) Avail: NTIS CSCL 17/9

The author discusses basic problems in the theory of large radar systems consisting of groups of spaced radar stations distributed over the territory, information processing devices and data transmission devices. Radar systems are classified on the basis of an analysis of functions allocated among the components of the system. The authors propose an effectiveness function for large radar systems and examine the effectiveness in relation to the quality indices and engineering parameters of the system. The main classes of radar systems, i.e., independent, noncoherent, videocoherent, coherent and multistage systems are analyzed. The authors develop operational control principles and methods for a radar system during its operation. GRA

N74-18836# Harris Electro-Optics Center of Radiation, Ann Arbor, Mich.
MATCHED FILTER OPTICAL PROCESSOR Final Report, May 1972 - May 1973
Wai-hon Lee and Milton O. Greer Aug. 1973 52 p refs
(Contract F30602-72-C-0303)
(Rept-8124-F-1; AD-771792; RADC-TR-73-224) Avail: NTIS CSCL 17/9

A new tracking optical processor which uses a computer generated matched filter to process the synthetic aperture radar data is described. The general consideration in generating the matched filter is discussed in detail and some experimental results are presented. Author (GRA)

N74-18837# Geophysical Survey Systems, Inc., North Billerica, Mass.
THEORETICAL ANALYSIS OF IMPULSE PROPAGATION IN DISSIPATIVE MEDIUM
Ron V. Row, Rexford M. Morey, and Charles L. Bertram May 1973 83 p refs
(Contract N00014-71-C-0392; NR Proj. 387-059)
(AD-772107; TR-005-73) Avail: NTIS CSCL 20/14

The propagation of a short electromagnetic pulse from an antenna in one medium across a sharp plane interface into a second electrically conducting medium was studied via a model which is based on infinite plane waves. Although general analytical results were obtained numerical computations were necessarily made for a particular pulse shape (Gaussian) and duration (2 nanoseconds) and a limited range of material constants and depths. These results support the qualitative conclusions drawn from the theory and permit estimates of the effects of increasing conductivity and depth on the transmitted pulse shape and amplitude. A few simple experiments with water of various salinity (conductivity) which are reported here also support the

conclusions of the theory. It is shown how the effects of a generally stratified medium may be handled in the theory by using transfer matrix multiplication. (Modified author abstract) GRA

N74-18838# Stanford Univ., Calif. Electronics Lab.
RESEARCH ON THE INTERACTION OF THE LOWER ATMOSPHERE WITH ELECTROMAGNETIC WAVES OF MILLIMETER WAVELENGTH THROUGH LINE-OF-SIGHT PROPAGATION STUDIES Final Report, 1 Dec. 1971 - 31 Jul. 1973
Alan T. Waterman, Jr. Aug. 1973 33 p refs
(Contract F19628-71-C-0050; AF Proj. 8682)
(AD-772824; SU-SEL-73-040; AFCRL-TR-73-0563) Avail: NTIS CSCL 20/14

The report describes a continuing program of research in the propagation of millimeter waves over a 28-km line-of-sight path using sampling arrays of antennas. Experimentally, two frequencies (34.89 and 11.63 GHz) are used. Directly measured quantities are amplitude and relative phase at each of eight receiving antennas (on the higher frequency), as received from each of two transmitting antennas. The report describes the data-taking procedure, recent modifications made to the equipment, and various data-reduction techniques. Emphasis is on the small signal fluctuations arising from atmospheric turbulence. (Modified author abstract) GRA

N74-19440* Smithsonian Astrophysical Observatory, Cambridge, Mass.
COMBINED OBSERVATIONS OF METEORS BY IMAGE-ORTHICON TELEVISION CAMERA AND MULTI-STATION RADAR
A. F. Cook, G. Forti, R. E. McCrosky, A. Posen, R. B. Southworth, and J. T. Williams *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 23-44 refs (For availability see N74-19436 10-30)
(Contract NSR-09-015-033)
CSCL 17I

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N74-18839 Saskatchewan Univ., Saskatoon.
SELF-OPTIMIZING ALLOCATION SYSTEMS Ph.D. Thesis
Lorne George Mason 1973 267 p
Avail: Univ. Microfilms Order No. 73-24815

The selection of a control strategy or the allocation of finite resources in such a manner as to optimize some measure of performance are discussed. Self-optimizing controllers are theoretically synthesized and two variants of these controllers are considered in detail. The first variant is applicable to situations where it is desired to select an optimal strategy from amongst a finite set of alternatives. The controllers are modeled by stochastic automata. A simple communications network is then simulated, where the proposed controllers are used to route calls through the network. It is shown that the proposed decentralized control scheme attains the optimal network performance. A resource allocation problem is formulated, where the environment of the proposed controllers is modeled by a set of quasi-linear, quasi-stationary differential equations. Dissert. Abstr.

N74-18840*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DESIGN AND PERFORMANCE OF A LARGE VOCABULARY DISCRETE WORD RECOGNITION SYSTEM. VOLUME 1: TECHNICAL REPORT
Nov. 1973 75 p refs 2 Vol.
(Contract NAS8-25701)
(NASA-CR-120165; MDC-G4829-Vol-1) Avail: NTIS HC $6.75 CSCL 09B

The development, construction, and test of a 100-word vocabulary near real time word recognition system are reported. Included are reasonable replacement of any one or all 100 words in the vocabulary, rapid learning of a new speaker, storage and retrieval of training sets, verbal or manual single word deletion, continuous adaptation with verbal or manual error correction, on-line verification of vocabulary as spoken, system modes selectable via verification display keyboard, relationship of classified word to neighboring word, and a versatile input/output interface to accommodate a variety of applications. Author

N74-18841*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DESIGN AND PERFORMANCE OF A LARGE VOCABULARY DISCRETE WORD RECOGNITION SYSTEM. VOLUME 2: APPENDIXES
Nov. 1973 125 p
(Contract NAS8-25701)
(NASA-CR-120164; MDC-G4829-Vol-2) Avail: NTIS HC $9.25 CSCL 09B

The users manual for the word recognition computer program contains flow charts of the logical diagram, the memory map for templates, the speech analyzer card arrangement, minicomputer input/output routines, and assembly language program listings. G.G.

N74-18842*# Stanford Research Inst., Menlo Park, Calif.
DESIGN OF A FAULT TOLERANT AIRBORNE DIGITAL COMPUTER. VOLUME 2: COMPUTATIONAL REQUIREMENTS AND TECHNOLOGY Final Report
R. S. Ratner, E. B. Shapiro, H. M. Zeidler, S. E. Wahlstrom, C. B. Clark, and J. Goldberg Oct. 1973 151 p refs
(Contract NAS1-10920)
(NASA-CR-132253) Avail: NTIS HC $10.75 CSCL 09B

This final report summarizes the work on the design of a fault tolerant digital computer for aircraft. Volume 2 is composed of two parts. Part 1 is concerned with the computational requirements associated with an advanced commercial aircraft. Part 2 reviews the technology that will be available for the implementation of the computer in the 1975-1985 period. With regard to the computation task 26 computations have been categorized according to computational load, memory requirements, criticality, permitted down-time, and the need to save data in order to effect a roll-back. The technology part stresses the impact of large scale integration (LSI) on the realization of logic and memory. Also considered was module interconnection possibilities so as to minimize fault propagation. Author

N74-18843*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CREW/COMPUTER COMMUNICATIONS STUDY. VOLUME 1: FINAL REPORT
J. D. Johannes Feb. 1974 144 p refs
(Contract NAS8-25701)
(NASA-CR-120163; MDC-G5312) Avail: NTIS HC $10.25 CSCL 09B

Techniques, methods, and system requirements are reported for an onboard computerized communications system that provides on-line computing capability during manned space exploration. Communications between man and computer take place by sequential execution of each discrete step of a procedure, by interactive progression through a tree-type structure to initiate tasks or by interactive optimization of a task requiring man to furnish a set of parameters. Effective communication between astronaut and computer utilizes structured vocabulary techniques and a word recognition system. G.G.

N74-18844# Cambridge Univ. (England). Dept. of Engineering.
PROCESSING ROUTINES AIDED BY GRAPHICS FOR MANIPULATION OF ARRAYS
J. Billingsley and J. L. Moughton 1973 9 p refs
(CUED/B-Control/TR-51) Avail: NTIS HC $4.00

PRAGMA has been written in FORTRAN and consists of a suite of routines designed and developed to ease the analysis of data. Routines within the suite cover smoothing, filtering, reduction to zero mean, reduction to zero trend, correlation, convolution, delay, differentiation, addition of arrays and scaling. Perhaps the most useful means of data input is by means of an optical scanner, enabling graphical data to be input directly.

Analogue and paper tape inputs are also provided. Development of the package was stimulated by a requirement to analyze medical plethysmograph traces in a relatively intuitive way. After digitizing, smoothing and differentiation, the traces displayed prominent features indicating any abnormalities. Author

N74-18845# Cambridge Univ. (England). Dept. of Engineering.
ALGORITHMS AND SYSTEM DESIGN PACKAGES
M. D. C. Dyne, ed. and Margaret O. Mutch, ed. 1973 171 p refs
(CUED/B-Control/TR-45) Avail: NTIS HC $11.75

In order that a rapid understanding of available programs may be obtained, the specifications of various algorithms are being produced and many are described. As time has progressed it has become apparent that much greater use may be gained by integrating a number of the algorithms into a suite of subroutines. Three of these applications packages are described. Author

N74-18846# National Bureau of Standards, Washington, D.C.
NETWORK USER INFORMATION SUPPORT
A. J. Neuman Dec. 1973 27 p refs
(Grant NSF AG-350)
(NBS-TN-802) Avail: SOD HC $0.60 as C13.46:802

With increasing interest in the development of computer networks and the proliferation of remote entry capability from user terminals, user support takes on new dimensions. Some user characteristics are outlined as they affect user support. User support requirements are identified for training, terminal operation, and general information to aid in network operations. Support capabilities include on-line aids, information available on request, and tutorial information available at the terminal. Author

N74-18847# National Bureau of Standards, Washington, D.C.
COMPLETE CLEAR TEXT REPRESENTATION OF SCIENTIFIC DOCUMENTS IN MACHINE-READABLE FORM
Blanton C. Duncan and David Garvin Feb. 1974 55 p refs
(NBS-TN-820) Avail: SOD HC $0.90 as C13.46:820

Science and technology use a large variety of symbols to represent physical properties, chemical formulas and mathematical expressions. Data centers that codify and evaluate physical properties need to use this conventional symbolism in their work. It is demonstrated that these conventional symbols can be produced by modern communications devices that are compatible with the international standard codes for information interchange. A set of characters suitable for representing scientific data and text is presented and proposed as an extension of the ISO information interchange code. The use of this extended character code by computer oriented data centers at the National Bureau of Standards is described. The equipment needed for this level of performance and criteria for their selection are outlined. Author

N74-18848# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
COMPUTER NETWORKING: APPROACHES TO QUALITY SERVICE ASSURANCE
Rona B. Stillman Jan. 1974 26 p refs
(Grant NSF AG-350)
(NBS-TN-800) Avail: SOD HC $0.60 as C13.46:811

Quality service assurance in a (generalized) computer networking environment is addressed. In the absence of any direct, well defined, quantitative measure of service quality and reliability, error collection and analysis is the only basis for service quality control. Therefore, mechanisms are described which facilitate reporting of operational errors, documentation of error corrections, and collection of system performance data. Since techniques for hardware quality control are well known, these mechanisms focus on collecting data which can be used to assess and control software quality. Finally, specific network facilities are described which support research in the area of software quality, and potential areas of new research using the network are identified. Author

N74-18849# National Bureau of Standards, Washington, D.C. Computer Systems Engineering Div.
REVIEW OF COMPUTER NETWORKING TECHNOLOGY
Robert P. Blanc Jan. 1974 135 p refs
(Grant NSF AG-350)
(NBS-TN-804) Avail: SOD HC $1.55 as C13.46:804

Technical characteristics of existing computer networks, including data communication technology and configuration related to support of resource sharing services for a computer network are summarized. Included are discussions of terminal support capabilities for the communications network and a development of relevant network terminology. A comparative evaluation of existing technological approaches to networking is included. Author

N74-18850# National Bureau of Standards, Washington, D.C. Computer Systems Engineering Div.
NETWORK MANAGEMENT SURVEY
Ira W. Cotton Feb. 1974 91 p refs
(Grant NSF AG-350)
(NBS-TN-805) Avail: SOD HC $1.20 as C13.46:805

The results of a study of management practices in different computer networks are reported. Five networks were chosen as typical of different approaches to network implementation and management: Defense Advanced Research Projects Agency (ARPA) Network, MERIT Network, Triangle Universities Computation Center (TUCC), Oregon State Regional Network and Tymmet, a commercial network. A common format is employed to survey each network. While the report is not intended to be prescriptive, some empirical observations are presented for each topic covered. Author

N74-18851# Cambridge Univ. (England). Dept. of Engineering.
CLUE: RAYTHEON USER'S MANUAL
J. L. Moughton and J. Billingsley 1973 27 p refs
(CUED/B-Control/TR-46) Avail: NTIS HC $4.50

The Raytheon 703 computer is used extensively in connection with projects including predictive control, graphical curve optimization and the analysis of medical data. The clue operating system relies heavily on visual display for communication and magnetic tape overlay to provide one user with the exclusive use of the machine; it is designed for both the FORTRAN and the assembly language programmer. G.G.

N74-18852# TRW Systems Group, Redondo Beach, Calif.
SOFTWARE WORKSHOP 1973
1973 71 p
Avail: NTIS HC $6.75

Problems in computer program developments constitute cost and schedule overruns, inability to meet performance specifications, zero management visibility, and inadequate or nonexistent documentation. Management functions to solve these problems constitute analyses of error sources in evaluating requirements, program design, coding and system execution processes as well as hardware realization. G.G.

N74-18853# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
GOVERNMENT LOOKS AT PRIVACY AND SECURITY IN COMPUTER SYSTEMS
Clark R. Renninger, ed. and Dennis K. Branstad, ed. Feb. 1974 47 p refs Conf. held at Gaithersburg, Md., 19-20 Nov. 1973
(NBS-TN-809) Avail: SOD HC $0.85 as C13.46:809

The proceedings of a conference held for the purpose of highlighting the needs and problems of Federal, State and local government in safeguarding individual privacy and protecting confidential data contained in computer systems from loss or misuses are summarized. The origin of governmental problems is discussed in the context of the public's concern for privacy arising out of computer based recordkeeping, the diverse legislative actions now being taken to safequard privacy, the threats to the security of computer based information systems and the technological problems associated with protecting against such threats. Author

N74-18854# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
BASIC STATEMENT TIMES FOR ALGOL 60
B. A. Wichman Nov. 1973 69 p refs
(NPL-NAC-42) Avail: NTIS HC $6.50

Working details of a method of evaluating the processing speed of an ALGOL system using the times of execution for basic statements are presented. Notes on all the time obtained to date (10/10/73) are also included. A more detailed analysis has been added since the production of a similiar report.
Author (ESRO)

N74-18855# Preussische Bergwerks- und Huetten A.G., Hannover (West Germany).
ORGANIZATION OF AN INTEGRATED INFORMATION SYSTEM FOR THE EXPLORATION OF OCEAN MINERAL RESOURCES [AUFBAU EINES INTEGRIERTEN INFORMATIONSSYSTEMS DER ROHSTOFFBEZOGENEN MEERESFORSCHUNG]
Wolfgang Ehrismann and Helga Kupfernagel Bonn Bundesmin. fuer Forsch. und Technol. Nov. 1973 66 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FBM-73-04) Avail: NTIS HC $6.50; ZLDI, Munich 13,45 DM

A FORTRAN program package for the processing of marine resources research data is described as a basis of an integrated data storage and information system. The system factors are preprocessing, data file, and method file. The preprocessing part of the system monitors, checks, and amends the incoming data; the data file stores them hierarchically; and the method file links the user with the data file. This letter file has the following fuctions: information, mapping, and trend analyses. Examples of how to apply this system are given. Author (ESRO)

N74-18856# Massachusetts Inst. of Tech., Cambridge.
A USER'S GUIDE TO THE MACRO CONTROL LANGUAGE
Steven P. Geiger Dec. 1973 31 p
(Contract N00014-70-A-0362-0006; ARPA Order 2095; Proj. MAC)
(AD-771435; MAC-TM-36) Avail: NTIS CSCL 09/2

The report describes the use of new language for the control of physical processes. Programs written in Macro Control Language are subjected to a translator/scheduler where they undergo a traditional compilation as well as automatic processor scheduling among the various processes which are controlled. The memo explains the syntax and semantics of the Macro Control Language. It also gives step-by-step instructions for writing programs and for running them on the M.I.T. Electrical Engineering Department's PDP-11/45 DELPHI system.
Author (GRA)

N74-18857# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THE POSSIBILITY OF CONSTRUCTION OF AN ALGORITHMIC GENERAL-PURPOSE HYBRID COMPUTER
G. E. Pukhov 27 Nov. 1973 14 p refs Transl. into ENGLISH from Mat. Modelirovaniya i Teorii Elektr. Tsepei (Kiev), no. 9, 1971 p 3-9
(FTD Proj. T74-05-12)
(AD-772018; FTD-HT-23-319-74) Avail: NTIS CSCL 09/2

In the present work an attempt is made to examine certain problems relative to the algorithmic general-purpose hybrid computer which has the following components: a common digital memory, a common control unit and two arithmetic devices, the first of which is digital and the second is a code-controlled algebraic converter of continuous electrical voltages. GRA

N74-18858# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALL-UNION SEMINAR ON THE TOTAL-SYSTEM SOFTWARE OF THE MINSK-32 DIGITAL COMPUTER
I. I. Malashinin and N. G. Zaitsev 10 Dec. 1973 6 p Transl. into ENGLISH from the publ. "Seminar Upravlyayuschie Mashiny i Sistemy, Trudy, No. 1" USSR, Sep./Oct. 1972 p 135-136 Conf. held 27-30 Mar. 1972
(AD-771608; FTD-HT-23-551-74) Avail: NTIS CSCL 09/2

The purpose of the seminar was the familiarization of its participants with the developed system software of the Minsk-32 computer. The seminar included the general characteristics and structure of the system software, organization and description of the data, and also the characteristics of the basic parts of the software: general purpose subprogram; the information-providing program; and the standard problems program, which is most characteristic for ASUP. GRA

N74-18859# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
ASSOCIATIVE PROCESSING APPLIED TO PATTERN RECOGNITION Final Report, 1 Jul. 1972 - 30 Jun. 1973
Ralph M. Heller 20 Sep. 1973 31 p refs
(Contract F44620-73-C-0004; AF Proj. 9769)
(AD-771075; AFOSR-73-2130TR) Avail: NTIS CSCL 09/2

The basic goal of the contract was to study, from the algorithmic point of view, ways in which the relatively new concept and technology of associative processors could be applied to the large-scale computations required in the digital approach to processing for pattern recognition and image processing. In addition, technical reports produced on the contract are listed as well as past and planned oral and written presentations. (Modified author abstract) GRA

N74-18860# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
AN EXPERIMENTAL STUDY OF MOMENT METHODS FOR AUTOMATIC IDENTIFICATION OF THREE-DIMENSIONAL OBJECTS FROM TELEVISION IMAGES Ph.D. Thesis
Sahibsingh Amulsingh Dudani Aug. 1973 237 p refs
(Grant AF-AFOSR-2048-71; AF Proj. 9769)
(AD-771662; AFOSR-73-2136TR) Avail: NTIS CSCL 09/2

The report extends the two-dimensional method of moments for pictorial pattern recognition to the identification of three-dimensional objects from optical images. The identification is independent of object position or orientation in three-dimensional space. The method developed is applied in an experimental system using a television camera and a computer for obtaining and processing live images of model airplanes. In a six class problem in which the same images were presented to human observers and to the computer, the computer error rate was approximately five percent while the human rate was ten percent. The errors in both cases were due primarily to low resolution and noise in the optical system. Author (GRA)

N74-18861# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
A PROGRAM FOR LOWER BOUND OF LOGIC AND STATE ASSIGNMENTS
Subhash C. Gupta May 1973 48 p refs
(Grant DA-ARO(D)-31-124-72-G65)
(AD-771130; AROD-10196-3-RT; TR-3) Avail: NTIS CSCL 09/2

The report describes a computer program, Program STAP, which calculates the lower bound of logic required and gives a state assignment approaching this limit for a completely specified synchronous machine. The program was implemented in FORTRAN 4 on the IBM 370/165 computer. The procedures used and test examples are given. Author (GRA)

N74-18862# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
ON STATE ASSIGNMENT AND REALIZATION OF SEQUENTIAL MACHINES
Subhash C. Gupta Jun. 1973 82 p refs
(Grant DA-ARO(D)-31-124-72-G65)
(AD-771129; AROD-10196-4-RT; TR-4) Avail: NTIS CSCL 09/2

The design of minimal cost synchronous sequential machines is achieved by automating the state assignment procedure, the solution of the sequential machine using the next state table and the state assignment chosen, and finally, the optimization of the solution. (Modified author abstract) GRA

N74-18863# Maryland Univ., College Park.
ON TRAVERSING PROPERTIES OF ARRAY AUTOMATA
Anupam N. Shah Nov. 1973 138 p refs
(Contract N00014-67-A-0239-0012)
(AD-772130; TR-274) Avail: NTIS CSCL 09/2

The purpose of the report is to study the pattern traversal power of various two-dimensional automation models. It is shown that traversing a pattern is equivalent to accepting a pattern that has at least one point with a certain local property. On the

other hand, the existence of an automaton that halts after traversing a pattern is equivalent to the existence of an automaton that accepts a pattern having no point with a certain local property. It is proved that there is no FSAA (finite state array automaton) that halts after traversing an arbitrary pattern, though there exists an FSAA that traverses simply connected patterns. GRA

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N74-18864 Arizona State Univ., Tempe.
FORMULATIONS AND SOLUTIONS FOR HOMOGENEOUS AND INHOMOGENEOUS CHANNEL FIELD EFFECT Ph.D. Thesis
Genard T. Catalano 1973 220 p
Avail: Univ. Microfilms Order No. 73-31584

Numerical solutions for junction field effect devices have been accomplished for homogeneous and inhomogeneous channel profiles. The first numerical solutions are achieved for the junction FET using a model very similar to Shockley's, with the equations appropriately modified to take into account the inhomogeneous channel. Significant improvement of operation of the JFET can be accomplished by the use of inhomogeneous channel doping profiles with heavier doping near the source than the drain end. The second formulation is based upon the fact that the channel has a net space change present. Under these conditions, a new formulation is made based on the solution of Poisson's equation and the current equation including drift.
Dissert. Abstr.

N74-18865 Wisconsin Univ., Madison.
ANALYSIS AND DESIGN OF SINUSODIAL OSCILLATORS Ph.D. Thesis
S.-N. Yeh 1973 216 p
Avail: Univ. Microfilms Order No. 73-21188

Analyses and improvements of the frequency and amplitude stabilities of sinusoidal oscillators with nonideal amplifiers or negative resistances are the major aspects of this thesis. Some results concerning the expressions for the frequency and amplitude stability factors in terms of the linear network parameters are obtained. Contrary to the common notion that null-network oscillators have better frequency stability, it is shown that biquadratic transfer function oscillators with zeroes close to the positive real axis of the complex frequency plane will possess higher frequency as well as amplitude stabilities. Nonlinear analysis of near sinusoidal self-oscillations in second-order systems has resulted in the new expressions for the harmonic distortions and the harmonic distortion factors, the amplitude of oscillation, the frequency shift, the frequency and amplitude sensitivities with respect to the variation in the amplifier or negative resistance. The analytic results obtained are confirmed by the computer analysis of the corresponding differential equations.
Dissert. Abstr.

N74-18866+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COMPUTER-ASSISTED CALCULATION OF THE RESPONSE OF A p-n JUNCTION CAPACITOR TO A STEP-VOLTAGE INPUT
A. Dutta-Roy Feb. 1973 15 p refs
(INPE-295-RI/084) Avail: NTIS HC $4.00

A computer program using a predictor-corrector method of integration is employed to calculate the transient response of voltage-dependent p-n junction capacitor. From practical and tutorial points of view this method gives a better insight compared to analytical techniques. Sample response-curves for abrupt, linearly-graded, and hyperabrupt junction capacitors with different conditions of inputs and loadings are shown. Author

N74-18867*# Duke Univ., Durham, N.C. Dept. of Electrical Engineering.
STATIC dc TO dc POWER CONDITIONING-ACTIVE RIPPLE FILTER, 1 MHz dc TO dc CONVERSION, AND NONLINEAR ANALYSIS Ph.D. Thesis
William August Sander, III 23 Mar. 1973 210 p refs
(Grant NGL-34-001-001)
(NASA-CR-137300) Avail: NTIS HC $13.50 CSCL 09C

Dc to dc static power conditioning systems on unmanned spacecraft have as their inputs highly fluctuating dc voltages which they condition to regulated dc voltages. These input voltages may be less than or greater than the desired regulated voltages. The design of two circuits which address specific problems in the design of these power conditioning systems and a nonlinear analysis of one of the circuits are discussed. The first circuit design is for a nondissipative active ripple filter which uses an operational amplifier to amplify and cancel the sensed ripple voltage. A dc to dc converter operating at a switching frequency of 1 MHz is the second circuit discussed. A nonlinear analysis of the type of dc to dc converter utilized in designing the 1 MHz converter is included. Author

N74-18868*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
METAL-OXIDE-METAL POINT CONTACT JUNCTION DETECTORS Final Technical Report, 1 Sep. 1970 - 31 Aug. 1973
Jack Baird, R. H. Havemann, and R. D. Fults 31 Aug. 1973 25 p refs
(Grant NGR-06-003-160)
(NASA-CR-137259) Avail: NTIS HC $4.25 CSCL 09A

The detection mechanism(s) and design of a mechanically stable metal-oxide-metal point contact junction detector are considered. A prototype for a mechanically stable device has been constructed and tested. A technique has been developed which accurately predicts microwave video detector and heterodyne mixer SIM (semiconductor-insulator-metal) diode performance from low dc frequency volt-ampere curves. The difference in contact potential between the two metals and geometrically induced rectification constitute the detection mechanisms. G.G.

N74-18869*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SYMMETRICAL ODD-MODULUS FREQUENCY DIVIDER Patent Application
Alexander Engel, inventor (to NASA) (JPL) Filed 12 Mar. 1974 9 p
(Contract NAS7-100)
(NASA-Case-NPO-13426-1; US-Patent-Appl-SN-450503) Avail: NTIS HC $4.00 CSCL 09A

A frequency divider arrangement is reported that can be used for division by an odd number and which provides a symmetrical waveform output. The value of N is determined for any odd modulus by which it is desired to divide a frequency, and the divide by 2N counter is then obtained as well as an exclusive OR gate to receive one input signal from the source.
NASA

N74-18870*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONVERTER DESIGN TECHNIQUES AND APPLICATIONS
Vincent R. Lalli 1974 23 p refs Proposed for presentation at Semiconductor Electron. Conf., Cleveland, 9 May 1974; sponsored by IEEE
(NASA-TM-X-71513; E-7896) Avail: NTIS HC $4.25 CSCL 09E

Transistorized direct current voltage converters offer a number of advantages over other types because of their small size, low weight, high efficiency, high reliability, precision accuracy and wide range of control. There are three basic types of converter subsystems: series converter in which a voltage-controlled component is placed in series with the load; shunt converter in which a current-controlled component is placed in shunt with the load; and a switching converter in which a voltage-controlled component is turned on and off in series with the load. Converters employing any of these three types of subsystems can provide constant voltage, constant current, or constant impedance across the load. Design and application considerations, step-by-step design procedures, and the solution to sample design

problems for the series, shunt, and switching types are presented. Author

N74-18871# Sandia Labs., Albuquerque, N.Mex.
THEORETICAL STUDY OF THE EFFECTS OF IONIZING RADIATION ON DIFFUSED RESISTORS
J. G. Fossum Sep. 1973 59 p
(Contract AT(29-1)-789)
(SLA-73-702) Avail: NTIS HC $5.00

A theoretical study of diffused resistors in an ionizing radiation environment is described. The two basic effects - conductivity modulation, which is generally insignificant or can easily be rendered so, and photocurrent generation, the consequences of which essentially determine the diffused resistor hardness - are examined. Typical diffused resistors are shown to be quite invulnerable to ionizing radiation, and the feasibility of using them in hardened integrated circuits is implied theoretically. Designed guidelines to achieve optimum hardness are enumerated. Author (NSA)

N74-18872# Honeywell, Inc., Lexington, Mass.
MERCURY CADMIUM TELLURIDE 10.6-MICRON PHOTODIODE Interim Report, 15 Dec. 1972 - 15 Jun. 1973
T. Koehler Dec. 1973 45 p
(Contract DAAB07-71-C-0236)
(AD-771064; ECOM-0236-3) Avail: NTIS CSCL 09/1

The first six months of a program to achieve a 10.6-micrometer (Hg,Cd)Te photodiode thermoelectrically cooled module is described. The feasibility of such a module has been clearly demonstrated. A quantum efficiency of 55%, bandwidth of 156 MHz, and a saturation current of 3 mA at 146K is achieved. The program will continue for another six months during which the TE cooler-detector interface will be demonstrated. (Modified author abstract) GRA

N74-18873# Systems Research Labs., Inc., Dayton, Ohio.
A FACILITY FOR THE CHARACTERIZATION OF ELECTRO-OPTICAL IMAGING DEVICES Final Report, Jun. 1972 - Jul. 1973
Ronald N. Hubbard, Harold L. Iffland, and Joseph Fraggiotti Nov. 1973 171 p refs
(Contract F33615-72-C-1847; AF Proj. 6102)
(AD-771754; SRL-6765; AFAL-TR-73-301) Avail: NTIS CSCL 09/1

A detailed definition of the facilities required for comprehensive investigation of a wide variety of electro-optical (E-O) imaging devices is presented. The types of E-O devices whose characteristics were quantified are: (1) camera tubes, (2) infrared image devices, (3) image intensifiers, and (4) solid state imaging devices. These devices were first analyzed to determine their internal and external design characteristics. Operating parameters were then evaluated so that the measurement techniques capable of quantifying their performance could be defined. The test configurations needed to test each parameter for each type of device were defined. Particular emphasis was placed on selecting test setups which permitted maximum commonality between device types to arrive at a modular and integrated facility. After the functional requirements for each piece of test equipment were established, a survey of sources of test equipment was conducted and off-the-shelf items were specified to the greatest extent practicable. (Modified author abstract) GRA

N74-18874# Rome Air Development Center, Griffiss AFB, N.Y.
ELECTRON BEAM MICROANALYSIS OF ELECTROCHEMICAL ATTACK ON THIN FILM NICKEL-CHROMIUM RESISTORS
John J. Bart Oct. 1973 38 p refs
(AF Proj. 5519)
(AD-772677; RADC-TR-73-220) Avail: NTIS CSCL 09/1

The purpose of the report is to present the results of the electron beam microanalysis (EBM) studies which have led to the development of a model for the observed electrochemical reaction. The intent was to correlate, principally through use of an electron microprobe, the various chemical characteristics of the integrated circuit with the behavior of thin film nickel-chromium resistors. Other pertinent features of the devices were studied with several additional techniques including scanning electron microscopy and mass spectrometry. GRA

N74-18875# Stanford Univ., Calif. Center for Materials Research.
SYNTHESIS OF COMPOUND SEMICONDUCTING MATERIALS AND DEVICE APPLICATIONS: GALLIUM NITRIDE LIGHT EMITTING DIODES
D. A. Stevenson and H. P. Maruska Dec. 1973 216 p refs
(Grant DAHC15-72-G-0006; ARPA Order 1644)
(AD-772503; CMR-73-17) Avail: NTIS CSCL 09/1

The synthesis and characterization of hetero-epitaxial gallium nitride (GaN) films were undertaken with particular reference to the phenomenon of light emission. Gallium nitride was grown by the chemical vapor deposition technique using sapphire substrates. Techniques for characterization included optical, scanning electron, and transmission electron microscopy and measurements of various electrical and optical properties of the films. The thin films of GaN were doped during growth with zinc and magnesium to form n-i junctions. Such material provided the basis for the fabrication of m-i-n light-emitting diodes, which emitted light in the high-energy violet region of the visible spectrum with Mg doping and green light with Zn doping. (Modified author abstract) GRA

N74-18876# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
METHOD OF MOMENTS APPLICATIONS. VOLUME 4: FEEDLINE INTERFERENCE WITH DIPOLE PERFORMANCE THEORY AND EXPERIMENT Phase Report, Jun. 1972 - Feb. 1973
E. Mendelovicz, A. T. Adams, Kenneth Siarkiewicz (RADC), and A. Mendelovicz Oct. 1973 51 p refs
(Contract F30602-72-C-0360; AF Proj. 4540)
(AD-773173; RADC-TR-73-217-Vol-4) Avail: NTIS CSCL 09/5

The characteristics of thin-wire, finite-gap, half wave length and quarter wavelength dipoles fed with a length of two-wire transmission line were studied using matrix methods. Transmission line length and gap size were varied obtaining the complete solution (current distributions, impedance and far field beam patterns) in each case. Significant departures from the ideal dipole characteristics are found even for electrically small gap sizes and transmission line lengths. When the departures are small, they can be described adequately by the relative magnitude of cross polarized field components and by null fill-in. Cross polarization effects are minimized by choosing transmission line length equal to (wavelength) where n is an integer. Departures from ideal dipole performance are significantly increased by reducing dipole length and by current imbalance. Some of the effects noted have been verified experimentally. Author (GRA)

N74-18877# Naval Research Lab., Washington, D.C.
DEVELOPMENT OF A WIDEBAND LOW-NOISE L-BAND TRANSISTOR AMPLIFIER Final Report
Raymond P. Meixner Dec. 1973 42 p refs
(NRL Proj. R02-86; RF12151)
(AD-772529; NRL-MR-2695) Avail: NTIS CSCL 09/5

At microwave frequencies, the recently developed small signal arsenic-diffused-emitter transistors offer high gain, reasonable compression levels, and low noise figure at low-bias levels. These characteristics make them attractive for use in low-noise preamplifiers in RF front ends of a multiport phased-array radar receiver. This report describes the development of a two-stage common-emitter amplifier, operating between 800 and 1400 MHz, using conventional microstrip techniques having a spot noise figure less than 4.00 db, at a gain of 26.5 db. Computer-aided design routines were used to obtain final designs from transistor S-parameters. Noise figure and stability criteria are discussed. Author (GRA)

N74-18878# Westinghouse Research Labs., Pittsburgh, Pa.
THIN FILM DISPLAY SWITCHES Final Report, 1 Apr. 1971 - 31 May 1973
Thomas P. Brody, Peter C. Y. Chen, and Karl K. Yu Dec. 1973 77 p refs
(Contract N00014-71-C-0269; NR Proj. 215-169)
(AD-772544; Rept-73-9F2-PRNTM-R1) Avail: NTIS CSCL 09/5

A thin film transistor analog of an MNOS memory device was proposed as a grey level storage element for a solid state

X-Y addressed display panel. Work was performed on sputtered Si3N4 layers in combination with thermal SiO2 on silicon and sputtered SiO2 on CdS films, and memory behavior was observed, flat band voltage shifts of 5V being obtained with gate pulses of plus or minus 35V. A new system was constructed to allow fabrication in a single pumpdown cycle. A modified device using CdSe, SiO2 and Al2O3, with a floating metal gate, was designed and fabricated in the new system. An X-Y addressible matrix of memory and switching transistors was designed, intended to control an ac EL phosphor layer deposited directly on top of the thin film matrix. Individual memory devices were shown to be able to control the brightness of associated EL phosphor elements. The thin film layout of the matrix was completed and masks were designed. (Modified author abstract) GRA

N74-18879# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
THE EFFECTS OF IONIZING RADIATION ON GALLIUM ARSENIDE PHOSPHIDE METAL-INSULATOR-SEMICONDUCTOR STRUCTURES
Gordon J. Kuhlmann Aug. 1973 110 p refs
(Contract N00014-68-A-0158)
(AD-772546; EE-213(73)ONR-005) Avail: NTIS CSCL 09/1

MIS capacitors were fabricated on n-type GaAs0.5P0.5 using a thermally grown chromium-doped insulator and chromium gate electrode. The fabrication procedures which lead to stable devices are described. The devices were exposed to both Co60 gamma rays and high-energy electrons. A qualitative model which relies on carrier injection and trapping in the GaAsP disordered region is proposed to explain the observed radiation-induced space charge buildup in the capacitors. Radiation-induced increases in the fast interface-state density were generally less than 15 percent of the pre-irradiation values and were found to be independent of radiation type and dose, as well as the gate bias applied during irradiation. Thermal annealing experiments show that the radiation-induced charge can be completely annealed at a temperature of 150C, independent of the gate bias applied during annealing. (Modified author abstract) GRA

N74-18880# Naval Research Lab., Washington, D.C.
PATTERNS AND POLARIZATIONS OF SIMULATED CONFORMAL ARRAYS Final Report
J. K. Hsiao and A. G. Cha 13 Nov. 1973 24 p refs
(NRL Proj. R02-33)
(AD-772530; NRL-7615) Avail: NTIS CSCL 09/5

A conformal array on a surface of small curvature can be approximated by a number of planar arrays, several of which may be excited simultaneously so as to achieve a performance similar to that of a conformal array. Since the main beam of a planar array can be steered to any direction in visible space, several arrays, each oriented in a different direction, can be steered cooperatively to form a single beam in a desired direction. A general formulation of the radiated field of such a configuration of arrays is developed with the aid of formulas which relate the components into which a vector is resolved in one orthogonal coordinate system with those into which the same vector is resolved in a second orthogonal coordinate system. (Modified author abstract) GRA

N74-18881# Purdue Univ., Lafayette, Ind. School of Electrical Engineer.
SHORT-PULSE SWITCHES FOR AIRBORNE HIGH-POWER SUPPLIES Final Report, 31 Jul. 1972 - 31 May 1973
David B. Miller and Hannis W. Thompson, Jr. Wright-Patterson AFB, Ohio AFAPL Nov. 1973 102 p refs
(Contract F33615-72-C-2097; AF Proj. 3145)
(AD-772815; AFAPL-TR-73-81) Avail: NTIS CSCL 09/1

Prototypes of both magnetically and optically activated high current, high voltage switches are fabricated and tested. Feasibility is demonstrated for both the silicon optically-activated and the indium antimonide, magnetically-activated switches. A near-intrinsic silicon switch shows resistance decrease of almost four orders of magnitude with radiation from Xenon flash lamps. Resistance increase of an InSb cube is demonstrated; this result leads to theoretical predictions of three orders of magnitude resistance increase for a corbino-disk device with modest fields (1-3 wb/sq m). Author (GRA)

N74-18882# Defense Documentation Center, Alexandria, Va.
DISPLAY DEVICES Report Bibliography, Mar. 1964 - Aug. 1973
Jan. 1974 539 p refs
(AD-772850; DDC-TAS-74-3) Avail: NTIS CSCL 09/5

The bibliography contains unclassified and unlimited citations on Display Devices. This report is topically arranged into the following subtopics: Section (1) Cathode Ray Tubes and Screens; (2) Head Up Display; (3) Television Display Systems; (4) Stereoscopic Display Systems; (5) Viewing Screens, and (6) Miscellaneous. These citations are studies and analyses relating to display systems techniques, equipment, electronic components, development, evaluation and design requirements. Corporate Author-Monitoring Agency, Subject, Title, and Personal Author indexes are included. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N74-18883 University of Southern Calif., Los Angeles.
TEST SEQUENCE GENERATION FOR MICROELECTRONIC CIRCUITS Ph.D. Thesis
Larry Herbert Canter 1973 290 p
Avail: Univ. Microfilms Order No. 73-31331

In order to fault test large scale integrated (LSI) circuit chips successfully, efficient algorithms are necessary. The physics of field effect devices, their usage as logic elements, and techniques for implementing dc, two phase, and four phase logic on LSI chips are presented. This material provides a basis for the development of fault test algorithms. The faults associated with an LSI chip, such as inversion errors or pinholes are investigated and enumerated. Fault test procedures are developed to detect and sometimes locate these faults. The first algorithm to be considered assumes that not more than a single fault occurs in the circuit. Two other specific algorithms are conceived that assume the possibility of more than one fault. Dissert. Abstr.

N74-18884 Post Office Research Dept., London (England). Research Dept.
AN EXPERIMENTAL FREQUENCY MULTIPLEX/DEMULTIPLEX NETWORK (32 TO 50 GHz) FOR TE SUB 01 - MODE WAVEGUIDE SYSTEMS
W. K. Ritchie 1972 15 p refs
(R-316) Copyright. Avail: Issuing Activity

An experimental frequency multiplex/demultiplex network suitable for a TE sub 01-mode long distance circular waveguide system is described. It is constructed in rectangular waveguide and covers the band 32-50 GHz. Each stage of frequency separation is achieved using directional filters composed of two identical 3db couplers and two identical bandpass or highpass filters. Methods of design and construction of the directional couplers and filters are described. Insertion loss and signal distortion performance of the assembled network are shown. Author

N74-18885# Cambridge Univ. (England). Dept. of Engineering.
ANALYSIS AND PARTIAL OPTIMIZATION OF A NONLINEAR STOCHASTIC CONTROL SYSTEM
A. T. Fuller 1973 27 p refs
(CUED/B-Control/TR-50) Avail: NTIS HC $4.50

A second-order control system with a saturating controller and a random disturbance is considered. It is known that when the control signal preceding the saturator is a linear combination of state coordinates, the steady-state probability density in state space may be obtained by solution of the Fokker-Planck equation. It is shown that when the mean-square-error is minimized the saturator operates as a relay; and the optimal parameter of the switching line is calculated. The explicit results obtained make the system a useful test case for computational solutions of the Fokker-Planck equation, and in other investigations of nonlinear stochastic control systems Author

N74-18886# Sandia Corp., Albuquerque, N.Mex.
MICROCIRCUITS: IR STUDIES ENHANCED BY AN INTERACTIVE MINICOMPUTER SYSTEM
B. Stiefeld 1973 9 p Presented at the IEEE Northeast Electron. Res. and Eng. Meeting, Boston, 6 Nov. 1973 Sponsored by AEC
(SLA-73-5515; Conf-731103-1) Avail: NTIS HC $3.00

The determination of temperature across the surface of a microcircuit is frequently of importance during the design phases of a project. Noncontact IR techniques are a natural choice to perform this operation. Minicomputer-based techniques are described that minimize the problems of emissivity variation and radiance-to-temperature conversion that are associated with IR-scanning techniques. Data are acquired and displayed using interactive procedures which are intended to enhance the ability of the concerned designers both to obtain the exact data desired and to display them in the most desirable manner.
Author (NSA)

N74-18887# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
A RELIABILITY MODEL FOR VARIOUS SWITCH DESIGNS IN HYBRID REDUNDANCY Interim Report
Ashok Ingle and Daniel Siewiorek Oct. 1973 47 p refs
(Contract F44620-73-C-0074; AF Proj. 9769)
(AD-771663; AFOSR-73-2173TR) Avail: NTIS CSCL 09/2

Various switch designs for the hybrid redundancy scheme are studied. A reliability model for the switch is developed and the switch is shown to be a significant factor in the overall system reliability. A hybrid redundancy scheme with a triple-modular redundant (TMR) core may have a maximum attainable reliability for only a spare or two. Adding spares complicates the switch enough to cause the system reliability to actually decrease. There exist conditions under which the switch becomes so complex that simple TMR would yield a better solution. Models for fault-tolerant switch designs are also obtained. Finally, various designs are compared via their reliability models.
Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N74-18888 Duke Univ., Durham, N.C.
PERFORMANCE CHARACTERISTICS OF A PNEUMATIC TUBE TRANSPORTATION SYSTEM Ph.D. Thesis
Joseph John Cudlin 1973 182 p
Avail: Univ. Microfilms Order No. 74-1129

The limitations and deficiencies of the conventional models of ground transportation have prompted the proposal of a number of innovative high speed systems for future urban and interurban mass transit. Those which appear to offer the most desirable operating characteristics are systems which utilize an enclosed guideway. The power requirements for high speed ground transportation are, however, potentially high. Since the power required for propulsion of surface vehicles at higher speeds is largely that needed to overcome aerodynamic drag, enclosed guideway systems, operated at reduced internal pressures, are proposed to offer a more practical means for high speed ground transportation. A pneumatic tube transportation system would propel carrier vehicles through tube guideways by the combined effects of continuous evacuation of the guideway length ahead of the vehicle and the admission of air at a higher pressure to the guideway behind the vehicle. Dissert. Abstr.

N74-18889*# Universities Space Research Association, Charlottesville, Va. Lunar Science Inst.
[SCIENTIFIC AND ADMINISTRATIVE ACTIVITIES AT THE LUNAR SCIENCE INSTITUTE] Semiannual Status Report, 15 Jul. - 31 Dec. 1973
5 Feb. 1974 43 p refs
(Contract NSR-09-051-001)
(NASA-CR-137081) Avail: NTIS HC $5.25 CSCL 14B

The scientific and administrative activities of the Lunar Science Institute during the period 15 July through 31 December 1973 are reported. The subjects discussed are: (1) contributions of the organization, (2) organization of the staff, (3) administration functions, and (4) scientific and professional meetings held at the institute. Author

N74-18890*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STATION READINESS TEST FOR THE EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS) MISSION
Mar. 1972 359 p
(NASA-TM-X-68582; STDN-401.1/ERTS) Avail: NTIS HC $21.00 CSCL 22D

The purpose of this SRT is to establish testing procedures which will verify that ERTS supporting stations can effectively support the ERTS mission. This SRT is applicable to all supporting stations for the ERTS-A and ERTS-B mission. Author

N74-18891*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TWO STAGE LIGHT GAS PLASMA PROJECTILE ACCELERATOR Patent Application
Edward L. Shriver, David W. Jex, and Edward B. Igenbergs, inventors (to NASA) (NAS-NRC) Filed 29 Jan. 1974 10 p
(NASA-Case-MFS-22287-1; US-Patent-Appl-SN-438147) Avail: NTIS HC $4.00 CSCL 14B

A device for accelerating a projectile to extremely high velocities, composed of a light gas accelerator to impart an initial high velocity to the projectile and a plasma accelerator and compressor receiving the moving projectile and accelerating it to higher velocities, is described. A capacitor bank is discharged into a plasma generator in timed relationship to the position of the projectile so that the moving plasma drags the projectile along with it. Projectile velocities in the order of 20 kilometers per second, the average meteoroid velocity, can be attained, whereby the accelerator finds particular utility in the field of meteoroid simulation. NASA

N74-18892# Cranfield Inst. of Technology (England). Centre for Transport Studies.
MAGNETIC SUSPENSION AND GUIDANCE OF HIGH SPEED VEHICLES Final Report
I. A. Alston, J. M. Clark, and J. T. Hayden Dec. 1972 53 p refs
(CTS-2) Avail: NTIS HC $5.75 CSCL 13F

Technical and economical assessments of magnetic suspensions for high speed vehicles and transport systems are reported. In these suspensions the suspending magnet takes the form of a powerful superconducting electromagnet that induces currents while it moves over conducting sheets or loops. A number of vehicle track designs are evaluated for operating cost effectiveness. It is shown that propulsion systems using power collected from the track are more expensive than those using power generated onboard the vehicle, and that the conducting sheet suspension is slightly more expensive than the null flux suspension. Author

N74-18893# Joint Publications Research Service, Arlington, Va.
RADIATION INSTALLATIONS AT THE TOMASK POLYTECHNICAL INSTITUTE
A. N. Didenko 1 Mar. 1974 14 p Transl. into ENGLISH from Izv. Vysshikh Vchebn. Zavedenii, Fiz. (Tomsk), no. 12, Dec. 1972 p 23-31
(JPRS-61364) Avail: NTIS HC $4.00

A discussion is presented of the various radiation installations at the Tomsk Polytechnical Institute. The 1.5 GeV electron synchrotron, waveguide synchrotrons, microtrons, induction accelerators, cyclotrons, and the 2.5 MeV electrostatic generator are described. Author

N74-18894# Joint Publications Research Service, Arlington, Va.
RESEARCH DEVELOPMENT ON THE CREATION OF LINEAR ELECTRON ACCELERATORS IN THE MOSCOW PHYSICAL

ENGINEERING INSTITUTE
O. A. Valdner 28 Feb. 1974 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz. (Tomsk), no. 12, 1972 p 14-22
(JPRS-61358) Avail: NTIS HC $4.00

The various uses of charged particle accelerators, circular iris waveguides, and high-frequency separators are discussed. Author

N74-18895*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECT OF WIND TUNNEL WALL INTERFERENCE ON THE PERFORMANCE OF A FAN-IN-WING VTOL MODEL
Harry H. Heyson Washington Feb. 1974 232 p refs
(NASA-TN-D-7518; L-9202) Avail: NTIS HC $6.00 CSCL 14B

A fan-in-wing model with a 1.07-meter span was tested in seven different test sections with cross-sectional areas ranging from 2.2 sq meters to 265 sq meters. The data from the different test sections are compared both with and without correction for wall interference. The results demonstrate that extreme care must be used in interpreting uncorrected VTOL data since the wall interference may be so large as to invalidate even trends in the data. The wall interference is particularly large at the tail, a result which is in agreement with recently published comparisons of flight and large scale wind tunnel data for a propeller-driven deflected-slipstream configuration. The data verify the wall-interference theory even under conditions of extreme interference. A method yields reasonable estimates for the onset of Rae's minimum-speed limit. The rules for choosing model sizes to produce negligible wall effects are considerably in error and permit the use of excessively large models. Author

N74-18896# Joint Publications Research Service, Arlington, Va.
COSMONAUT TRAINING CENTER AND ZVEZDNYY GORODOK DESCRIBED
A. Fedorov 21 Mar. 1974 11 p Transl. into ENGLISH from Sovetskaya Rossiya (Moscow), 4, 5 and 7 Dec. 1973 3 p
(JPRS-61543) Avail: NTIS HC $4.00

A description is given of the training and living quarters of the cosmonauts. Author

N74-18897# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
INSTALLATION OF TURBINE-FUELS RESEARCH COMBUSTOR LABORATORY Final Report
C. A. Moses Dec. 1973 28 p
(Contract DAAD05-70-C-0007)
(AD-772945; AFLRL-27) Avail: NTIS CSCL 21/4

A laboratory especially designed for the study of fuel-related problems in the operation of turbine engines has been installed at the U.S. Army Fuels and Lubricants Research Laboratory. The air supply system provides a clean, smooth flow of air to the combustion test cell at rates up to 2.5 lbs/sec; pressures to 16 atm and temperatures to 1500F are possible at all flow rates. The fuel delivery system is capable of pumping fuels ranging in properties from gasoline to No. 5 diesel at flow rates of over 1 gpm and pressures over 1000 psi. Up to 50 channels of thermocouple and transducer signals are sampled; the data reduction is performed on-line with test results available immediately. The system has been designed for maximum flexibility and growth. Conceivably, any combustion chamber and associated rig can be plugged-in, instrumented, and operated within the air flow capabilities of the laboratory. Author (GRA)

N74-18898# Royal Aircraft Establishment, Bedford (England). Aero/Flight Dept.
A FOUR DEGREES OF FREEDOM, COCKPIT MOTION MACHINE FOR FLIGHT SIMULATION
L. H. Warton London ARC 1973 62 p refs Supersedes RAE-TR-72075; ARC-056
(RAE-TR-72075; ARC-34056; ARC-R/M-3727) Avail: NTIS HC $6.25; HMSO £2.25; PHI $8.80

A machine for reproducing aircraft motions on a flight simulator cockpit, was developed. The four freedoms of the machine are actuated by hydraulic servos. The equipment is part of the piloted flight simulator facility used for research and development studies in the Aerodynamics Department of the Royal Aircraft Establishment at Bedford. The control and safety procedures used when operating the machine within the simulator facility, are described. The limitations of the performance achieved are discussed both with a view to finding ways to improve the existing machine, and to point out those particular aspects of design which need careful attention and uncompromising implementation on any future project. Author (ESRO)

N74-18899# Army Foreign Science and Technology Center, Charlottesville, Va.
TEST STAND FOR RESEARCH INTO THE EFFECT OF PHYSICAL PROPERTIES OF GASES ON THE CHARACTERISTICS OF A CENTRIFUGAL COMPRESSOR
A. B. Barenboim 26 Jul. 1973 9 p refs Transl. into ENGLISH from Kholod. Ter. Tekhnol. (Kiev), 1970 p 90-95
(AD-771089; FSTC-HT-23-2153-72) Avail: NTIS CSCL 13/7

Design of a test stand for investigating the effect of physical properties of gases on the characteristics of centrifugal compressors is discussed. Results of the testing of a compressor with nitrogen gas are reported. GRA

N74-18900# Scripps Institution of Oceanography, La Jolla, Calif. Advanced Ocean Engineering Lab.
PARAMETRIC STUDY OF A COLUMN SUPPORTED FLOATING AIRFIELD
30 Jun. 1973 43 p Sponsored in part by ARPA prepared in part by Glosten (L. R.) and Associates, Inc.
(Contract N00014-69-A-0200-6012)
(AD-771672; AOEL-48) Avail: NTIS CSCL 01/5

The report discusses the feasibility of construction of a large base or airfield at sea using stabilized legs. The legs, connecting struts, and other equipment would be transported by barge to the building site. There, the barge and payload would be flipped to the vertical and assembled with the option that the barge might or might not be included as a part of the platform. GRA

N74-18801 Bunker-Ramo Corp., Westlake Village, Calif.
EVALUATION OF THE ROLE OF THE SIMULATOR IN TRAINING AIRBORNE ASW OPERATIONS
James E. Robins, Dorothy L. Finley, and Thomas G. Ryan *In* AGARD Behavioural Aspects of Aircraft Accident Dec. 1973 8 p Sponsored by Naval Training Equipment Center (For availability see N74-18797 10-05)

N74-19468* TRW Systems, Redondo Beach, Calif.
THE COSMIC DUST ANALYZER: EXPERIMENTAL EVALUATION OF AN IMPACT IONIZATION MODEL
J. F. Friichtenicht, N. L. Roy, and D. G. Becker *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 299-310 refs (For availability see N74-19436 10-30) CSCL 14B

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N74-18901 Georgia Inst. of Tech., Atlanta.
DAMPING OF AXIAL INSTABILITIES BY SOLID PROPELLANT ROCKET EXHAUST NOZZLES Ph.D. Thesis
Bangalore Ananthamurthy Janardan 1973 166 p
Avail: Univ. Microfilms Order No. 74-231

The results of an experimental investigation undertaken to determine the effects of various nozzle design parameters on the capabilities of typical solid propellant rocket exhaust nozzles to attenuate axial combustion instabilities are presented. The nozzles selected are representative of a single-ported submerged rocket nozzle (RN-I) and a multiple-ported rocket nozzle (RN-II). In pursuit of this objective several experimental studies were conducted with geometrically similar small-scale models of actual solid rocket nozzles. In addition to determining the attenuation provided by the small-scale models of the RN-I and RN-II nozzles,

this investigation was also concerned with determining the dependence of solid rocket nozzle damping upon (1) the depth of the cavity surrounding a submerged nozzle, (2) the secondary flow rate issuing from the cavity of a submerged nozzle, (3) the geometry of the convergent section of a solid rocket nozzle, and (4) the number of nozzles present in a multiple-ported nozzle cluster. Dissert. Abstr.

N74-18902 Colorado Univ., Boulder.
EXPERIMENTAL STUDY OF THE TURBULENT STRUCTURE AND HEAT TRANSFER OF A TWO DIMENSIONAL HEATED JET Ph.D. Thesis
Jawaid Bashir 1973 120 p
Avail: Univ. Microfilms Order No. 73-32511

Results from the kinetic energy balance for the turbulent velocity in an ambient two dimensional jet and temperature fluctuation balance for a heated two dimensional jet are reported. The jet was found to be self preserving at and beyond the 40 diameters downstream. A location of x over D = 40 was selected to measure the energy balance for the turbulent velocity and the temperature fluctuation balance. The measurements for ambient jet were compared with the existing data. In both the energy balance and the temperature fluctuation balance, production was found to be the most dominant term followed by dissipation, diffusion and then convection. In addition velocity and temperature spectra were measured. Their dependence on the jet center line, on position across the jet and on Reynolds number was determined. Dissert. Abstr.

N74-18903 City Univ. of New York.
NON-NEWTONIAN CAPILLARY JET INSTABILITY Ph.D. Thesis
Marvin Gordon 1973 274 p
Avail: Univ. Microfilms Order No. 74-664

The instability of non-Newtonian capillary jets in laminar and turbulent flow was investigated. Employing the techniques of high speed photography, two sets of data were obtained. The first consisted of perturbing the jets at a prescribed frequency and measuring the change in amplitude of a disturbance wave with time. In this way, dispersion curves were obtained for a number of fluids. Jet stability was also described by measuring the breakup length, or coherent portion of the stream, as a function of the velocity for jets ejected horizontally into still air. A systematic study was conducted to determine the effects of varying the polymer concentration and nozzle dimensions on the breakup curve of jets of a viscoelastic liquid. The actual shape of the breakup curve depends upon the relative magnitude of the elastic forces which act to upgrade stability, and the aerodynamic forces that tend to have an opposite effect.
Dissert. Abstr.

N74-18904 Cincinnati Univ., Ohio.
THE AERO/ACOUSTIC RESPONSE OF FINITE CHORD BLADE ROWS TO CIRCUMFERENTIAL INLET FLOW DISTORTION IN AN UNSTEADY, COMPRESSIBLE FLUID Ph.D. Thesis
C. Thomas Savell 1973 137 p
Avail: Univ. Microfilms Order No. 74-100

The problem is considered of non-uniform inlet flow transfer through a compressor of a jet engine. Two separate techniques are used to approximate the unsteady flow in the rotor. The first technique is the semi-actuator disc analysis which models the blade cascade as one dimensional wave guides. This method permits an extension from an isolated rotor to a compressor stage. Two parametric studies on the response of a loaded rotor to inlet distortions are done for a single rotor operating at off design conditions and a number of rotors operating at their design points. The second technique is based on unsteady thin airfoil theory. It is a more refined analysis capable of describing the effect of cascade solidity on the distortion transfer. The model consists of representing each blade by a moving doublet filament of finite length immersed in a compressible stream containing a velocity distortion. The study is limited to an unloaded, flat plate rotor. Dissert. Abstr.

N74-18905 Utah Univ., Salt Lake City.
SELECTED STATISTICAL PROPERTIES OF A HIGH VELOCITY TURBULENT BOUNDARY LAYER WITH SURFACE MASS ADDITION Ph.D. Thesis
Lamar Foster Moon 1973 196 p
Avail: Univ. Microfilms Order No. 74-189

The objective was to investigate the statistical properties of the turbulent flow field, produced by normal injection of air through a slotted wall into a two-dimensional boundary layer, bounded by a supersonic stream. Particular attention was given to determining the pressure-velocity-gradient correlation, as well as both pressure and velocity intensity, spectra, and length scales. Statistical properties in the boundary layer were obtained using a rapid response static pressure probe and a constant temperature anemometer. The small high frequency static pressure probe was designed and fabricated to measure the fluctuating pressure intensity and the pressure spectra throughout the boundary layer. Dissert. Abstr.

N74-18906 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE INTERACTION OF A TURBULENT FLAT-PLATE BOUNDARY LAYER WITH THE WAKE OF A CIRCULAR CYLINDER MOUNTED NORMAL TO THE PLATE Ph.D. Thesis
Rao Venkateswara Arimilli 1974 156 p
Avail: Univ. Microfilms Order No. 74-1073

The results of the mean-velocity measurements of the interaction of a turbulent flat-plate boundary layer with the wake of a circular mounted normal to the plate are presented for cylinder Reynolds numbers between 4,200 and 33,600. The results indicate that beyond 100 diameters downstream, the flow is similar when viewed discretely as a wake. Between 20 and 100 diameters, the flow is seen not to be similar partly because of the presence, in each of the planes parallel to the plate, of velocities higher than the uniform velocity that exists far from the plane of symmetry, and partly because such a similarity does not exist even in two-dimensional wakes. An explanation is given for the origin and the propagation of these higher velocities. Dissert. Abstr.

N74-18907 University of Southern Calif., Los Angeles.
THE VISCOUS, RADIATING HYPERSONIC BLUNT BODY PROBLEM Ph.D. Thesis
Richard Scott Passamaneck 1973 73 p
Avail: Univ. Microfilms Order No. 74-939

The viscous, radiating hypersonic flow past an axisymmetric blunt body is analyzed based on the Navier-Stokes equations, plus a radiative equation of transfer derived from the Milne-Eddington differential approximation. The fluid is assumed to be a perfect gas with constant specific heats, a constant Prandtl number, of order unity, a viscosity coefficient varying as a power, of the temperature, and an adsorption coefficient varying as the first power of the density and as a power of the temperature. The gray gas assumption is invoked, thereby making the adsorption coefficient independent of the spectral frequency. The method of matched asymptotic expansions is used in the analysis. It is shown that there is a far field precursor, composed of two regions, in which the fluid mechanics can be neglected for all practical purposes but are included for completeness. Dissert. Abstr.

N74-18908 Colorado Univ., Boulder.
SELF-SIMILAR JETS OF IDEAL FLUIDS Ph.D. Thesis
James Patrick Coughlin 1973 107 p
Avail: Univ. Microfilms Order No. 73-32523

The flow of an ideal weightless incompressible fluid from a region of high pressure through a slit into a vacuum is discussed. Under certain assumptions on the growth of the slit, the flow is shown to be self-similar. Explicit formulas for the velocity components along the free surface are derived in terms of the (unknown) geometry of the surface. It is further shown that the velocity gradients near the point at which the jet separates from the wall vary approximately inversely with the square root of the distance from the separation point. An iteration scheme is used to numerically determine the shape of the free surface. The scheme provides a quick method of determining the flow of any fluid with a free surface, providing the flow can be considered self-similar. Dissert. Abstr.

N74-18909 Iowa Univ., Iowa City.
SHOCK WAVE PROPAGATION IN A NON-UNIFORM,

NONEQUILIBRIUM GAS Ph.D. Thesis
Scott Shaw-Yun Maa 1973 116 p
Avail: Univ. Microfilms Order No. 73-30946

The phenomenon of shock wave propagation in a nonuniform and nonequilibrium gas was investigated theoretically. Solutions for both weak and strong shock waves have been obtained. In the case of weak shock, the mathematical tool employed is the method of strained coordinates, which comprises a transformation from the time-distance (x,t) coordinates into the characteristic (alpha, beta) coordinates, followed by a formal perturbation scheme, the first order equations are then solved by Laplace transformation method. For strong shock, the similarity transformation technique was applied; the similarity variables were found by the one-parameter group theory method, with the application of similarity transformation, the governing partial differential equations reduce to a set of ordinary differential equations which are solved numerically on the digital computer. Dissert. Abstr.

N74-18910 Northwestern Univ., Evanston, Ill.
ANALYSIS OF SOME TWO-PHASE FLOW PROBLEMS Ph.D. Thesis
Jitendra Gordhanbhai Patel 1973 180 p
Avail: Univ. Microfilms Order No. 73-30684

The use of both local volume averaging and of two new bounding principles in solving some complex multiphase flow problems is illustrated. Muskat's theory for multiphase flow through porous media has been derived from the first principles utilizing the concept of local volume averaging. A new correlation procedure has resulted from the analysis of two-phase, turbulent flow through packed beds. It is estimated that this method would reduce the experimental correlation effort to less than half of the present day practice. For its use, the procedure requires holdup measurements and a single-phase flow correlation for a representative packed bed model. Bounding principles are utilized to analyze the flow of incompressible, immiscible generalized Newtonian fluids in the following geometries: (1) Laminar-laminar, stratified flow through a tube; (2) Single-phase, turbulent flow through a tube; and (3) Laminar-turbulent, stratified flow through a tube. Dissert. Abstr.

N74-18911 Oklahoma Univ., Norman.
LINEARIZED BUOYANT MOTION IN A CLOSED CONTAINER Ph.D. Thesis
Robert Thomas Doty 1973 113 p
Avail: Univ. Microfilms Order No. 73-31471

The linearized set of equations that govern the thermally-driven natural convection flow of a Newtonian fluid are developed in a rational manner and the approximations involved are explicitly described. It is found that the inviscid interior region responds to a special average value of the temperature perturbation. The effect of the boundary layer is to smear out, or average, any circumferential variations in this perturbation so that the interior, in effect, responds to an isothermal boundary in each horizontal plate. The temperature and vertical velocity component are expressed simply in terms of this average container temperature. The horizontal velocity potential is governed by a Poisson equation whose general solution is developed in terms of a Neumann function that depends on the container geometry. Dissert. Abstr.

N74-18912 Stevens Inst. of Tech., Hoboken, N.J.
LARGE AMPLITUDE OSCILLATIONS OF A CIRCULAR CYLINDER IN A LOW-SPEED STREAM Ph.D. Thesis
John Allen Mercier 1973 143 p
Avail: Univ. Microfilms Order No. 74-884

The histories of the hydrodynamic forces acting on a circular cylinder oscillating with large amplitude motions (up to 3 diameters) in various kinds of ambient streams have been determined experimentally. The forces are found to be rather regular and periodic, with periods related to the period of oscillation, for a wide range of frequencies and stream velocities. The magnitude and frequency relations are not, however, the same for the various kinds of flow investigated: (1) with zero ambient stream velocity (2) with oscillations transverse to the stream and (3) with oscillations in-line-with the stream. The measurements were digitized and processed to derive Fourier Series representations, up to the fifth harmonic, and power spectral densities. True averages of the drag force were obtained by a specially-gated integrating voltmeter system. Dissert. Abstr.

N74-18913 West Virginia Univ., Morgantown.
SLOW VISCOUS FLOW OF A SPHERICAL PARTICLE IN STRAIGHT AND DEFORMABLE CYLINDRICAL TUBES Ph.D. Thesis
Yen Tsung Lin 1973 159 p
Avail: Univ. Microfilms Order No. 74-222

The flow behavior (streamlines, velocity profile and pressure distribution) of slow motion of a spherical particle in a moving incompressible Newtonian fluid through straight, dilated and deformable cylindrical tubes has been investigated. A three dimensional axi-symmetrical case is used in this study. For the straight tube, a theoretical approach is used but the numerical results were calculated by the finite-difference approximations. The results are compatible with those found in the literature. For the dilated cylindrical tube, the dilated curved boundary given by Lee and Fung is used but extended to the case containing a sphere located in the center of the tube. Again, a finite-difference method is used to solve this boundary-value problem. The results show that circulation is easier to form than in the straight tube and that the pressure drop is less than that of the straight tube. Dissert. Abstr.

N74-18914 California Inst. of Tech., Pasadena.
1: DEVELOPMENT OF A CRYOGENIC SHOCK TUBE. 2. EXPERIMENTAL INVESTIGATION OF THE INTERACTION OF A SHOCK WAVE WITH LIQUID HELIUM 1 AND 2 Ph.D. Thesis
John Chester Cummings, Jr. 1973 218 p
Avail: Univ. Microfilms Order No. 73-31039

A cryogenic shock tube has been developed as a tool for research in fluid mechanics and low temperature physics. The shock tube is designed to operate with the test section immersed in a cryogenic liquid. A unique diaphragm changing mechanism makes this shock tube an economical and practical device. There are several advantages in operating a shock tube at cryogenic temperatures. Shock waves of very large Mach number can be produced. The flow field can be accurately calculated using ideal shock tube - perfect gas theory. Boundary layer effects are decreased so that long test times are possible. The cases which have been studied are test gas temperatures of 300, 77, 4.2, and 2.3 K. Helium is used as both test and driver gas. The largest Mach numbers which have been observed range from 2.4 at 300 K to 32 at 2.3 K (several runs at 1.46 K have produced Mach 40 shocks). As the test gas temperature is decreased the observed Mach numbers approach those calculated using the ideal shock tube equation. Dissert. Abstr.

N74-18915 California Inst. of Tech., Pasadena.
NONLINEAR GAS OSCILLATIONS IN PIPES, 1. WAVE-TRAINS WITH SMALL DISSIPATION, 2 Ph.D. Thesis
Javier Jimenez 1973 108 p
Avail: Univ. Microfilms Order No. 73-31045

The problem is considered of forced acoustic oscillations in a pipe. The oscillations are produced by a moving piston in one end of the pipe, while a variety of boundary conditions ranging from a completely closed end to a completely open mouth are considered at the other end. All these boundary conditions are modelled by two parameters: a length correlation and a reflection coefficient equivalent to the acoustic impedance. The averaged Lagrangian method to analyze slowly varying non-linear wavetrains is modified to include cases with a small dissipation. To do this, a pseudo-variational principle is used in which the Lagrangian depends on the variable and the solution of the problem, and which can be used to describe irreversible processes. We prove the corresponding averaged equations to all orders and describe practical ways to use them to lowest order. Dissert. Abstr.

N74-18916*# Washington Univ., Seattle.
FLOWFIELD ANALYSIS FOR SUCCESSIVE OBLIQUE SHOCK WAVE INTERACTIONS WITH A TURBULENT BOUNDARY LAYER
C.-C. Sun and Morris E. Childs [1973] 29 p refs
(Grant NGR-48-002-047)
Avail: NTIS HC $4.50 CSCL 20D

A computation procedure is described for predicting flow fields which develop when successive interactions between oblique shock waves and a turbulent boundary layer occur. Computations were carried out for axisymmetric internal flows at free stream

Mach numbers = 3.82 and 2.82. The effect of boundary layer bleed was considered for the free stream Mach number = 2.82 flow. A control volume analysis is used to predict changes in the flow field across the interactions. Two bleed flow models were considered. A turbulent boundary layer program was used to compute changes in the boundary layer between the interactions. The results given are for flows with two shock wave interactions and for bleed at the second interaction site. In principle the method described may be extended to account for additional interactions. The predicted results are compared with measured results and are shown to be in good agreement when the bleed flow rate is low (on the order of 3 percent of the boundary layer mass flow), or when there is no bleed. As the bleed flow rate is increased, differences between the predicted and measured results become larger. Shortcomings of the bleed flow models at higher bleed flow rates are discussed. Author

N74-18917*# Kanner (Leo) Associates, Redwood City, Calif.
RESULTS OF THE COMBINED APPLICATION OF BOUNDARY LAYER AND PROFILE THEORY
Richard Eppler Washington NASA Mar. 1974 38 p refs
Transl. into ENGLISH from Z. Flugwiss (Brunswick), v. 8, no. 9, Sep. 1960 p 247-260
(Contract NASw-2481)
(NASA-TT-F-15416) Avail: NTIS HC $5.00 CSCL 20D

Applied results of combined boundary layer and profile theory show that it is possible to determine profiles with fixed characteristics of pressure distribution by means of which extensive boundary layer calculations can be carried out; series of profiles can be studied systematically and determination of profiles, analogous to procedure in wind tunnels, is possible. Theoretical possibilities are explained with examples. Author

N74-18918*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VELOCITY LAG OF SOLID PARTICLES IN OSCILLATING GASES AND IN GASES PASSING THROUGH NORMAL SHOCK WAVES
Barry R. Maxwell (Bucknell Univ., Lewisburg) and Richard G. Seasholtz Washington Mar. 1974 29 p refs
(NASA-TN-D-7490; E-7653) Avail: NTIS HC $3.25 CSCL 20D

The velocity lag of micrometer size spherical particles is theoretically determined for gas particle mixtures passing through a stationary normal shock wave and also for particles embedded in an oscillating gas flow. The particle sizes and densities chosen are those considered important for laser Doppler velocimeter applications. The governing equations for each flow system are formulated. The deviation from Stokes flow caused by inertial, compressibility, and rarefaction effects is accounted for in both flow systems by use of an empirical drag coefficient. Graphical results are presented which characterize particle tracking as a function of system parameters. Author

N74-18919# Cambridge Univ. (England). Dept. of Engineering.
FREE-STREAM TURBULENCE EFFECTS ON THE TURBULENT BOUNDARY LAYER
R. L. Evans 1972 47 p
(CUED/A-Turbo/TR-41) Avail: NTIS HC $5.50

The effects of increasing free stream turbulence on the turbulent boundary layer are summarized: (1) an increase followed by a decrease in displacement and momentum thickness; and (2) an increase in skin friction. Calculation methods, experimental apparatus, and data reduction are presented, along with the integral properties and turbulence structural properties of the results. J.A.M.

N74-18920# Cambridge Univ. (England). Dept. of Engineering.
FINITE ELEMENT ANALYSIS OF THE FLOW THROUGH A CASCADE OF AEROFOILS
David S. Thompson 1973 48 p refs
(CUED/A-Turbo/TR-45) Avail: NTIS HC $5.50

Finite element methods are applied to steady incompressible flow in two dimensional cascades of compressor blades. A triangular element is used, with a cubic interpolation for velocity potential or stream function, and the velocities at the nodes. An isoparametric version of this element is described for use at curved boundaries. The results are compared with exact solutions, experimental measurements and other numerical methods. Author

N74-18921# Cambridge Univ. (England). Dept. of Engineering.
STREAM TURBULENCE EFFECTS ON THE TURBULENT PROFILE BOUNDARY LAYER IN A COMPRESSOR CASCADE
R. L. Evans 1973 40 p refs
(CUED/A-Turbo/TR-43) Avail: NTIS HC $5.00

The turbulent profile boundary layer on a one foot chord compressor blade in cascade was measured under three different levels of free stream turbulence. Fuller velocity profiles, with a consequent decrease in displacement thickness, increased skin friction, and a decrease in the Coles' velocity profile wake component are found with increasing free stream turbulence level. The total pressure loss of a compressor cascade is found to increase at first, and then decrease with increasing levels of free stream turbulence, while the deviation angles decrease monotonically with increasing free stream turbulence. A procedure is given for modifying turbulent velocity profiles for the effects of free stream turbulence, based on velocity defect profiles. Author

N74-18922*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF AN ASYMMETRIC SHORT ANNULAR DIFFUSER WITH A NONDIVERGING INNER WALL USING SUCTION
Albert Juhasz Washington Mar. 1974 41 p refs
(NASA-TN-D-7575; E-7615) Avail: NTIS HC $3.25 CSCL 20D

The performance of a short highly asymmetric annular diffuser equipped with wall bleed (suction) capability was evaluated at nominal inlet Mach numbers of 0.188, 0.264, and 0.324 with the inlet pressure and temperature at near ambient values. The diffuser had an area ratio of 2.75 and a length- to inlet-height ratio of 1.6. Results show that the radial profiles of diffuser exit velocity could be controlled from a severely hub peaked to a slightly tip biased form by selective use of bleed. At the same time, other performance parameters were also improved. These results indicate the possible application of the diffuser bleed technique to control flow profiles to gas turbine combustors. Author

N74-18923# Advisory Group for Aerospace Research and Development, Paris (France).
AERODYNAMIC INTERFERENCE INDUCED BY REACTION CONTROLS
F. W. Spaid (McDonnell Douglas Corp., Huntington Beach, Calif.), L. A. Cassel (McDonnell Douglas Corp., Huntington Beach, Calif.), and R. E. Wilson, ed. (Naval Ordnance Lab., White Oak, Md.) Dec. 1973 66 p refs
(AGARDograph-173; AGARD-AG-173) Avail: NTIS HC $6.50

The literature pertaining to the interaction of a sonic or supersonic gaseous jet with a transverse external flow has been reviewed. The flowfields associated with these interactions are complex, and knowledge of them is based largely on results of experiments. Numerous examples of data from flatplate experiments are presented. These include static pressure distribution, induced forces, flowfield survey, and flow visualization results. Analyses and correlation techniques for jet interaction flows are discussed. The region upstream of a jet in two-dimensional flow is similar to the flow upstream of a forward-facing step, and the flow associated with a jet from a circular nozzle in a flat plate resembles the flow past a blunt-nosed slender body. The single most important variable in determining the scale of these interactions is the ratio of jet momentum flux to the external-flow dynamic pressure. When the external flow is subsonic, the interaction is sensitive to external-flow Mach number in the high subsonic Mach number range and to the ratio between jet and external flow velocity in the low Mach number range. Author

N74-18924# Advisory Group for Aerospace Research and Development, Paris (France).
DIGITAL TECHNIQUES IN TURBULENCE RESEARCH

C. H. Gibson (Calif. Univ., La Jolla) and P. A. Libby, ed. (Calif. Univ.) Dec. 1973 30 p refs
(Contracts DAHC04-72-C-0037; N00014-69-A-0200-6006; N00014-69-A-0200-6039; Grant NSF GA-28366)
(AGARDograph-174; AGARD-AG-174) Avail: NTIS HC $4.50

Rapid advances in electronic information processing capabilities are providing powerful tools for turbulence research. Massive quantities of experimental information are necessary to characterize most turbulent flows, given the primitive nature of theoretical understanding in the field. Analytical treatments are equally dependent on powerful, high speed computers to cope with the most truncated form of the full turbulence problem. Author

N74-18925*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BOUNDARY-LAYER ANALYSIS OF SUBSONIC INLET DIFFUSER GEOMETRIES FOR ENGINES NACELLES
James A. Albers and E. John Felderman Washington Mar. 1974 32 p refs
(NASA-TN-D-7520; E-7816) Avail: NTIS HC $3.25 CSCL 20D

Theoretical Mach number distributions and boundary-layer parameters are presented for subsonic nacelle inlet diffuser geometries with length to exit diameter ratios ranging from 0.4 to 1.6 and diffuser exit area to throat area ratios ranging from 1.1 to 2.0. The major portion of the study was done with a cubic diffuser contour with the inflection point at the midpoint of the diffuser, a diffuser throat Mach number of 0.6, and a free-stream Mach number of 0.12. Calculations were performed at both model (diffuser exit diameter, 30.5 cm) and full-scale (diffuser exit diameter, 183 cm) sizes. Separation limits were defined by establishing a separation boundary on plots of diffuser area ratio as a function of diffuser length to diameter ratio. The effects of diffuser contour, inlet lip geometry, and throat Mach number on the boundary-layer characteristics are illustrated. The major results of the study indicate that the separation boundary is shifted to greater area ratios by (1) increasing the diffuser length, (2) increasing the scale of the diffuser and, (3) moving the inflection point of the diffuser contour to or ahead of the midpoint of the diffuser. Author

N74-18926*# Case Western Reserve Univ., Cleveland, Ohio.
EXPERIMENTS ON CONFINED TURBULENT JETS IN CROSS FLOW Final Report
Yasuhiro Kamotani and Isaac Greber Washington NASA Mar. 1974 77 p refs
(Grant NGL-36-027-008)
(NASA-CR-2392) Avail: NTIS HC $4.00 CSCL 20D

Results are reported of experiments on the effects of an opposite wall on the characteristics of turbulent jets injected into a cross flow, for unheated and heated jets. Longitudinal and transverse distributions of velocity and temperature are presented for single and multiple circular jets, and trajectories are presented for two-dimensional jets. The opposite wall has relatively little effect on a single jet unless the ratio of jet to cross flow momentum flux is large enough for the jet to impinge on the opposite wall. For a row of jets aligned perpendicularly to the cross flow, the opposite wall exerts progressively larger influence as the spacing between jets decreases. Much of the effect of jet and wall proximity can be understood by considering the interaction of the vortex flow which is the major feature of the structure of a single jet in a cross flow. Smoke photographs are shown to elucidate some of the interaction patterns. Author

N74-18927*# Old Dominion Univ., Norfolk, Va. School of Engineering.
ON THE THEORY OF COMPLIANT WALL DRAG REDUCTION IN TURBULENT BOUNDARY LAYERS Final Report
Robert L. Ash Washington NASA Apr. 1974 43 p refs
(Contract NAS1-11707)
(NASA-CR-2387; TR-73-T8) Avail: NTIS HC $3.25 CSCL 20D

A theoretical model has been developed which can explain how the motion of a compliant wall reduces turbulent skin friction drag. Available experimental evidence at low speeds has been used to infer that a compliant surface selectively removes energy from the upper frequency range of the energy containing eddies and through resulting surface motions can produce locally negative Reynolds stresses at the wall. The theory establishes a preliminary amplitude and frequency criterion as the basis for designing effective drag reducing compliant surfaces. Author

N74-18928# Advisory Group for Aerospace Research and Development, Paris (France).
AN INVESTIGATION OF DIFFERENT TECHNIQUES FOR UNSTEADY PRESSURE MEASUREMENTS IN COMPRESSIBLE FLOW AND COMPARISON WITH LIFTING SURFACE THEORY
R. Destuynder (ONERA) and H. Tijdeman (NLR, Amsterdam, Netherlands) Jan. 1974 35 p Presented at the 37th AGARD Struct. and Mat. Panel Meeting, The Hague, 7-12 Oct. 1973
(AGARD-R-617) Avail: NTIS HC $4.75

Wind tunnel measurements of unsteady aerodynamic pressures at high subsonic speeds were conducted. The results obtained by two different procedures are presented. Flutter tests were also conducted on the same model as that used for unsteady pressure measurements. Natural frequencies and damping values were determined at constant Mach number and varying free-stream dynamic pressure. Tables of data and graphs are included to compare the results obtained by the two methods. Author

N74-18929# Sandia Corp., Albuquerque, N.Mex.
MEAN FLOW MEASUREMENTS IN HYPERSONIC TURBULENT NOZZLE WALL BOUNDARY LAYERS
C. W. Peterson 1973 44 p refs Presented at 40th Semiann. Meeting of the Supersonic Tunnel Asso., Bedford, Engl., 24-26 Sep. 1973 Sponsored by AEC
(SLA-73-5793; Conf-730932-2) Avail: NTIS HC $4.25

Boundary-layer pitot and total-temperature surveys were made at two stations on the wall of the Sandia Laboratories M = 14 hypersonic wind tunnel nozzle. Static pressure and temperature data were obtained at ten stations along the nozzle. All of these measurements were made at two test section Reynolds numbers of 3.38 million and 1.43 million per meter. Author (NSA)

N74-18930# Sandia Corp., Albuquerque, N.Mex.
PITOT PROBE MEASUREMENTS WITHIN THE LAMINAR BOUNDARY LAYER ON A RAPIDLY SPINNING OGIVE CYLINDER IN SUPERSONIC FLOW
O. L. George, Jr. and W. C. Ragsdale (Naval Ordnance Lab., Silver Spring, Md.) Nov. 1973 50 p refs
(Contract AT(29-1)-789)
(SLA-73-940) Avail: NTIS HC $4.50

A chronology, of a unique boundary-layer survey test is presented. Pitot pressure surveys of the laminar boundary layer on a tangent ogive cylinder spinning at rates as high as 23,000 rpm in Mach numbers 3 and 4.1 flow are described. The spin rates and Mach numbers are typical of those experienced by spin-stabilized projectiles, and the model shape is typical of these spin-stabilized projectiles. This type of data is of great utility in understanding the Magnus phenomenon, but has heretofore been available only for very slow spin rates in incompressible flow conditions. Author (NSA)

N74-18931# Oxford Univ. (England). Dept. of Engineering Science.
CAVITATION INCEPTION ON HYDROFOILS Ph.D. Thesis
M. V. Casey Sep. 1973 247 p refs Sponsored in part by Sci. Res. Council and Wolfson Coll.
(Rept-1071/73) Avail: NTIS HC $15.50

A theoretical and experimental study of some aspects of cavitation inception in the two-dimensional flow of water over a hydrofoil is presented. A computational procedure for predicting the pressure distribution and boundary layer development on an arbitrary hydrofoil immersed in the unbounded two-dimensional non-cavitating flow of an incompressible viscous fluid is described. The role of a laminar separation bubble in the inception of an attacked cavity on a hydrofoil is considered. New experimental work on both the cavitation inception characteristics and the position of the laminar separation bubble on a NACA 0015 hydrofoil has been designed and executed. ESRO

N74-18932# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.

NUMERICAL ANALYSIS OF THE NONSTEADY FLOW IN AXIAL COMPRESSORS [ANALISI NUMERICA DEL FLUSSO NONSTAZIONARIO IN COMPRESSORI ASSIALI]
Maurizio Pandolfi Nov. 1973 30 p refs In ITALIAN
(Publ-151) Avail: NTIS HC $4.50

The unsteady flow in axial compressors was calculated. In order to determine the propagation mechanism inside the turbomachine, a model was derived from the real machine, and analysis was limited to unsteady flow phenomena. Examples of unsteady numerical flow calculation are presented for two particular operating conditions. ESRO

N74-18933# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Automobili.
EVOLUTION OF AXISYMMETRIC SWIRLING FLOWS IN DUCTS [EVOLUZIONE DI FLUSSI VORTICOSI ASSIALSIMMETRICI IN CONDOTTI]
Giuseppe Bussi Nov. 1973 22 p refs In ITALIAN; ENGLISH summary
(Publ-153) Avail: NTIS HC $4.25

The equations that describe the evolution of compressible axisymmetric and inviscid fluid swirling flow in ducts are discussed assuming that the flow is in radial equilibrium and has a tangential velocity component. The choking conditions were found analytically using the variational calculus method. A numerical example of the evolution of a flow with uniform enthalpy and entropy and a rigid vortex is given. ESRO

N74-18934# Cambridge Univ. (England). Dept. of Engineering.
ROTATING STALL AND CASTING WALL BOUNDARY LAYERS IN AN AXIAL FLOW COMPRESSOR
C. Lakhwani London ARC 1973 18 p refs Supersedes ARC-33898
(ARC-CP-1255; ARC-33898) Avail: NTIS HC $4.00; HMSO 35p; PHI $1.55

The effect of casing wall boundary layers upon the rotating stall characteristics of an axial flow compressor in an isolated rotor row configuration is studied. The boundary layer was modified by fixing circular rings of different wire diameters to the outer casing. A significant alteration of the rotating stall characteristics was obtained for flow coefficient changes at stall onset and cessation. Author (ESRO)

N74-18935# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
SOME CALCULATIONS OF CONDITIONS AT THE INTERSECTION OF A WEAK SHOCK WAVE WITH A STRONG SHOCK
I. McGregor London ARC 1973 22 p refs Supersedes RAE-TR-72070; ARC-34013
(ARC-R/M-3728; RAE-TR-72070; ARC-34013) Avail: NTIS HC $4.25; HMSO 85p; PHI $3.55

Some comprehensive calculations of the flow conditions resulting from the intersection of a weak shock wave with a strong shock are presented and discussed, for a range of upstream Mach numbers between 1.4 and 2.8. Such flows are of interest in connection with the sub-critical stability of air intakes, for example, and in the interaction of shock waves and boundary layers. Author (ESRO)

N74-18936# TRW Systems Group, Redondo Beach, Calif.
AN EXPERIMENT ON THE WAKE OF A SLENDER PROPELLER-DRIVEN BODY Final Report, 15 Aug. 1971 - 30 Jun. 1973
R. L. Gran Jun. 1973 53 p refs
(Contract N00014-72-C-0074; ARPA Order 1910)
(AD-772234; TRW-20086-6006-RU-00) Avail: NTIS CSCL 20/4

The momentumless wake of a slender propeller-driven model in a wind tunnel at a Reynolds number of 63000 (based upon diameter) is examined using the hot-wire anemometer. Measurements of the mean flow field including swirl are presented, as well as measurements of the turbulent intensity and Reynolds stress within the first 20 diameters behind the model. The data are compared with a previous experiment at a similar Reynolds number using a blunt body and a high-speed jet as the propulsion source. A theoretical model of the flow is presented which describes the flow quite well, at one location. (Modified author abstract) GRA

N74-18937# California Inst. of Tech., Pasadena.
RESEARCH ON ENERGY EXCHANGE IN NONUNIFORM FLOW FIELDS Final Report
F. E. Marble, W. D. Rannie, and E. E. Zukoski Nov. 1973 32 p
(Contract F33615-72-C-1518; AF Proj. 7116)
(AD-771794; ARL-73-0138) Avail: NTIS CSCL 20/4

The research involved three separate investigations, all related to flow processes and energy exchange in suspensions of particles in fluids. The first investigation, concerned with a particle suspension in shear flow, is a longer-termed investigation and is being continued under separate funding. The result of preliminary experiments and a description of the experimental equipment for further work is given in Section I. The second investigation, on drag of spheres in an oscillating liquid, which has been under way for several years, was completed during this contract period. The importance of the Strouhal frequency, or vortex shedding frequency, in correlating drag measurements is demonstrated. The third investigation, analytical in nature, was undertaken to clarify the results of earlier experiments on the collision process in fluids. The results of the investigation are given. (Modified author abstract) GRA

N74-18938# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
FUNDAMENTAL RESEARCH IN APPLIED MATHEMATICS Final Report, 1 Jul. 1970 - 30 Sep. 1973
Frank W. J. Olver 5 Dec. 1973 8 p refs
(Grant DA-ARO(D)-31-124-72-G49)
(AD-772076; G-49-1; AROD-7319-15-M) Avail: NTIS CSCL 20/4

The report summarizes research carried out in the following areas: fluid dynamics; numerical analysis; asymptotic analysis. GRA

N74-18939# Southern Methodist Univ., Dallas, Tex. Thermal and Fluid Sciences Center.
THE SEPARATING TURBULENT BOUNDARY LAYER: AN EXPERIMENTAL STUDY OF AN AIRFOIL TYPE Technical Report, 1 Oct. 1971 - 1 Jul. 1973
James H. Strickland and Roger L. Simpson Aug. 1973 241 p
(Grant DA-ARO(D)-31-124-72-G31)
(AD-771170/8GA; WT-2; AROD-10092-2-E) Avail: NTIS HC $5.75 CSCL 20/4

Experimental measurements in a separating turbulent boundary layer were made. Mean velocity and turbulence intensity profiles were obtained using hot film and laser anemometry. Mean and fluctuating wall shear stress distributions were obtained using flush mounted hot film sensors. The bursting frequency at various streamwise locations was also obtained from the wall hot film sensors. The intermittency was obtained utilizing a photo-electric technique. The celerities of various eddy structures were obtained by using a double hot film probe. (Modified author abstract) GRA

N74-18940# Catholic Univ. of America, Washington, D.C. Dept. of Civil and Mechanical Engineering.
LAMINAR BOUNDARY LAYER IN SYMMETRY PLANE OF BLUNT-NOSED BODY
Russell A. Smith and Woo Taik Moon Nov. 1973 46 p refs
(Contract N00014-68-A-0506-0001)
(AD-772545) Avail: NTIS CSCL 20/4

The report presents the prediction of the points of instability, transition and separation together with the calculation of the incompressible laminar boundary layer properties on the windward and leeward meridians of a hemispheric nosed body of revolution at angles of attack, alpha-0 degrees, 10 degrees, 15 degrees and 20 degrees using an experimental pressure distribution. The three-dimensional solution for the boundary layer equations was obtained using a finite difference method. The prediction of the instability and transition points was made utilizing semi-empirical methods over a range of Reynolds numbers. (Modified author abstract) GRA

N74-18941# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
WALL PRESSURE FLUCTUATIONS AT SMOOTH AND ROUGH SURFACES UNDER TURBULENT BOUNDARY LAYERS WITH FAVORABLE AND ADVERSE PRESSURE GRADIENTS Technical Report, Sep. 1971 - Aug. 1972
Thomas E. Burton Jun. 1973 137 p refs
(Contract N00014-67-A-0204-0002; SR0090101)
(AD-772548; A/V-70208-9) Avail: NTIS CSCL 20/4

Fluctuating wall pressures under turbulent boundary layers with favorable gradients were measured at both smooth and rough walls. Wall pressure intensity was found to vary in proportion to mean wall shear stress between no-gradient and favorable-gradient flows. Adverse gradient boundary layers were studied over smooth and rough walls. These flows were not self-preserving, and results are presented as functions of longitudinal position. Pressure intensities were concentrated into a comparatively narrow band of frequencies. Pressure statistics are discussed. (Modified author abstract) GRA

N74-18942# Office of Naval Research, London (England).
MODIFICATION OF THE PATANKAR-SPALDING TWO DIMENSIONAL BOUNDARY LAYER CALCULATION PROCEDURE FOR THREE-DIMENSIONAL WINDWARD STREAMLINE PLANE
David F. Dyer 17 Sep. 1973 19 p refs
(AD-772706; ONRL-R-20-73) Avail: NTIS CSCL 20/4

An exact solution of the three-dimensional, turbulent, boundary layer equations in the symmetry plane on a body of revolution inclined with respect to the mean flow would be a valuable tool to researchers studying three-dimensional boundary layers. The present note reports such a solution technique which is based on a modification of the two-dimensional code developed by Patankar-Spalding. The two-dimensional code is used internationally by many researchers. The modification of the Patankar-Spalding Code is particularly attractive for the three-dimensional calculations since it is so widely used and understood by the research community and since it is shown to be easily modified for the three-dimensional symmetry plane calculation. GRA

N74-18943# United Aircraft Corp., East Hartford, Conn.
INVESTIGATIONS OF THE EFFECT OF COMBUSTOR GEOMETRY AND END NOZZLE FLOW ON THE PERFORMANCE OF GDL (GAS DYNAMIC LASER), TYPE DIFFUSERS Final Report, 17 Jan. - 17 Jul. 1973
Arthur E. Mensing and Francis R. Zumpano Nov. 1973 53 p refs
(Contract F33615-73-C-4077; AF Proj. 7064)
(AD-772777; M911621-7; ARL-73-0158) Avail: NTIS CSCL 20/4

An investigation was conducted to determine some of the performance characteristics of a high aspect ratio supersonic diffuser typical of those employed on gas dynamic laser devices. The experimental investigations were conducted in a sub-scale, cold flow test rig having the same Mach number and Reynolds number as the full scale Split Stage Demonstrator (SSD). Experiments and analysis were performed to determine the effect on diffuser performance of variations of the flow duct geometry upstream of the nozzle array and the effect of increased flow rate through the end nozzles of the array. Diffuser performance was determined from experimental measurements of the pressures in the simulated combustor and at the diffuser exit. (Modified author abstract) GRA

N74-18944# New York Univ., N.Y. Inst. of Mathematical Sciences.
MOTION OF A VORTEX IN A ROTATING LAYER OF FLUID BETWEEN RIGID CONCENTRIC SPHERES
A. S. Peters Sep. 1973 24 p
(Contract DA-ARO(D)-31-124-72-G113; ARPA Order 2069)
(AD-772504; IMM-398) Avail: NTIS CSCL 20/4

A preliminary report is concerned with the approximate description of two-dimensional vortical motion in a thin spherical layer of a gravitating, incompressible, inviscid fluid. The fluid is contained between an inner rotating rigid ball and an outer rigid concentric sphere and along with the inner spherical surface, has been rotating with constant angular velocity. The motion is supposedly due to the gravitational attraction of the rotating ball and to the sudden creation at t = 0 of concentrated vortices with axis normal to the spheres. GRA

N74-18945# Naval Ordnance Lab., White Oak, Md.
MEASUREMENTS OF UPSTREAM HISTORY EFFECTS IN COMPRESSIBLE TURBULENT BOUNDARY LAYERS
David F. Gates 26 Jul. 1973 102 p refs
(AD-772483; NOLTR-73-152) Avail: NTIS CSCL 20/4

The report describes an experimental study of compressible turbulent boundary layers for which the upstream history was systematically varied. A series of experiments was conducted using both a supersonic half nozzle and a conventional flat plate for which the nozzle throat and flat plate leading edge can be temperature controlled. The supersonic nozzle provided a favorable upstream pressure gradient together with a controlled thermal history at the throat. The flat plate provided upstream temperature control with no pressure history. Velocity and temperature profile and heat-transfer measurements were made in a downstream region of zero-pressure-gradient and constant wall temperature. (Modified author abstract) GRA

N74-18946# Rhode Island Univ., Kingston. Div. of Engineering Research and Development.
A METHOD OF DIRECT CALCULATION OF COMPRESSIBLE TURBULENT SKIN FRICTION AND HEAT TRANSFER IN THREE-DIMENSIONAL BOUNDARY LAYER FLOW Final Report, 1 Jun. 1972 - 31 May 1973
F. M. White and R. C. Lessmann 15 Jun. 1973 105 p refs
(Contract F33615-72-C-1509; AF Proj. 1366)
(AD-773165; AFFDL-TR-73-86) Avail: NTIS CSCL 20/4

The report concerns the calculation of coupled skin friction and heat transfer in compressible, turbulent, three-dimensional boundary layers. It presents an integral method of solution which assumes law-of-the-wall velocity and temperature correlations and results in three, coupled partial differential equations whose dependent variables are the dimensionless components of local skin friction and the dimensionless local heat transfer. The method allows for the specification of arbitrary distributions of free stream pressure, Mach number and wall temperature. The present theory is capable of handling problems of extreme complexity with moderate difficulty. (Modified author abstract) GRA

N74-18947# Advanced Technology Labs., Inc., Westbury, N.Y.
COMPUTATIONAL ANALYSIS OF UNSTEADY CIRCUMFERENTIAL AND RADIAL DISTORTION IN SUBSONIC DIFFUSERS Final Report, 3 Nov. 1972 - 30 Jun. 1973
John I. Erdos and John D. Ranlet Aug. 1973 117 p refs
(Contract F33615-72-C-1089; AF Proj. 1476)
(AD-773166; ATL-TR-182; AFFDL-TR-73-121) Avail: NTIS CSCL 20/4

Two computational models of the unsteady flow in the subsonic diffuser section of an axisymmetric, external compression, supersonic inlet are described. The first pertains to the inviscid flow on a cylindrical stream surface through the diffuser, from the terminal shock to a discharge station representing the engine face. The equations of motion for a compressible gas are solved numerically by a second order finite difference technique. Several numerical examples are carried out to illustrate the capabilities of the computational model; the results are discussed and interpreted in relation to the problem of experimental simulation of circumferential distortion. The second computational model pertains to the axisymmetric flow in meridional planes through the subsonic diffuser. (Modified author abstract) GRA

N74-18948# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
A SPECIAL GALERKIN METHOD FOR A CLASS OF STEADY TWO-DIMENSIONAL INCOMPRESSIBLE LAMINAR BOUNDARY-LAYER FLOWS Interim Report, Mar. 1972 - Jun. 1973
C.-C. Hsu Nov. 1973 68 p refs
(Contract F33615-72-C-1806; AF Proj. 7071)
(AD-773191; ARL-73-0167) Avail: NTIS CSCL 20/4

A class of steady two-dimensional incompressible laminar boundary layer flows is solved by the proposed Galerkin method in which the approximating functions are closely related to the

eigenfunctions of the governing equation. The method has been tested on two typical boundary layer flows of different nature, a linearly retarded flow and a flow past a circular cylinder. The analysis of the method and the numerical experiments on the two examples have indicated that highly accurate results for the entire flow region can be obtained only if the assumed finite series solution in the Galerkin's procedure satisfies closely the compatibility conditions of the problem. It also suggests that the set of approximating functions found is indeed general enough to permit solutions of all conceivable problems governed by the system of boundary layer equations considered. It is recommended that the method be investigated further by taking an assumed series solution which would satisfy more closely the compatibility conditions of the problems. Author (GRA)

N74-18949# Georgia Inst. for Research, Atlanta. School of Aerospace Engineering.
POTENTIAL FLOW STUDIES OF LIFT-FAN INFLOW INTERFERENCE PHENOMENA Final Report, 1 Feb. 1972 - 31 Jan. 1973
J. C. Wu, R. Sigman, J. Hubbartt, and H. McMahon Oct. 1973 119 p refs
(Contract F33615-72-C-1086)
(AD-773194; ARL-73-0132) Avail: NTIS CSCL 20/4

The report presents results of a study of the lift-fan inlet problem and includes a comprehensive survey of the existing experimental data and analytical methods, an analysis of the potential flow, and a boundary layer analysis for lift-fan inlets. Numerical solutions are presented for potential flows associated with inlet ducts set in an infinite plane with and without a centerbody simulating the hub of the fan. The effects of the cross flow to mean inlet velocity ratio, of the inlet and hub lip radii to duct width ratio, of the inclination of the duct axis to the plane, and of the position of the hub relative to the plane on the flow in and near the inlet ducts are discussed utilizing a two dimensional potential flow analysis. (Modified author abstract) GRA

N74-18950# Naval Postgraduate School, Monterey, Calif.
A THEORETICAL ANALYSIS OF JET DEFLECTION FROM PLANE AND AXISYMMETRIC CURVED OBSTACLES Ph.D. Thesis
Gerardo Hiriart Le-Bert Dec. 1973 130 p refs
(AD-773076) Avail: NTIS CSCL 20/4

A class of analytical and numerical solutions to the problem of inviscid-jet deflection from plane and axisymmetric concave surfaces are presented. The methods of solution for the two-dimensional cases includes a novel method developed in the present investigation, as well as those due to Levi-Civita and Riemann and Hilbert. These methods have provided indirect solutions for the shape of the curved solid boundary in terms of a given jet-departure and jet-deflection angle. The axisymmetric cases, namely, the deflection of axisymmetric jets from hemispherical thrust reversers are solved directly through the use of the finite element method and a novel iteration scheme. The real-fluid effects on the jet deflection are estimated by comparing the results with those obtained experimentally. (Modified author abstract) GRA

N74-19451* Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
MOTION OF A FRAGMENT IN DISTURBED AIR BEHIND A METEOR BODY
V. Padevet *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 169-174 refs (For availability see N74-19436 10-30)
CSCL 20D

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N74-18951 Wisconsin Univ., Madison.
TOWARDS UNDERSTANDING ENVIRONMENTAL IMPACT: MONITORING AND ANALYZING LEVELS OF EXISTING LAND ALTERATION Ph.D. Thesis
Michael Martin McCarthy 1973 217 p
Avail: Univ. Microfilms Order No. 73-21166

Both photographic and non-photographic remote sensing imagery data from 1940 to the present were collected for the study. Selectively timed color infrared aerial photography was found to be an effective means of monitoring levels of land alteration. Of all the photographic and non-photographic imagery, color infrared film taken during the spring was the most explicit in the delineation of areas of exotic and opportunistic plant communities and, conversely, the levels of existing impact. A central concern relates to methods of quantifying levels of environmental alteration. Quantification of these levels is presented by investigating means of mechanically analyzing a given film. Through a processes of sampling various quantified levels of impact are correlated with other environmental variables and the results presented. Dissert. Abstr.

N74-18952+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE THERMAL DIFFUSIVITY OF SOIL AT TROPICAL STATIONS IN SOUTHERN HEMISPHERE
Y. Viswanadham and N. JaganMohanaRao Jul. 1972 31 p refs
(INPE-214-RI/015) Avail: NTIS HC $4.75

The thermal diffusivity of the soil was determined at the sites Arapongas and Sao Jose dos Campos in Brazil, in accordance with the simple theory of periodic heat flow in a one dimensional, semi-infinite, homogeneous medium. The diffusivity increases with the increase of moisture content in the surface layers of the soil. The results of diffusivity obtained from these methods agree well with those obtained by other techniques. Author

N74-18953+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A STUDY OF OH(8,3) BAND EMISSION IN NIGHT AIRGLOW
Hisao Takahashi Feb. 1973 43 p refs
(INPE-314-RI/097) Avail: NTIS HC $5.25

General information about hydroxyl emission in night airglow is described. A spectroscopic study of OH band and the derivation of rotational temperature are presented. Author

N74-18954# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVIDENCE OF ENHANCED ELECTRON PRECIPITATION IN BRAZILIAN MAGNETIC ANOMALY IN ASSOCIATION WITH SUDDEN COMMENCEMENT
I. M. Martin, D. B. Rai, J. M. DaCosta, R. Palmeira, and N. B. Trivedi Sep. 1972 10 p refs
(INPE-237-RI/036) Avail: NTIS HC $4.00

Following the first satellite observations of enhanced particle flux in the region of the Brazilian Magnetic Anomaly, various attempts were made to detect effects associated with the precipitation of radiation belt particles over the region of this anomaly at balloon altitudes. Since 1968 balloon observations of charged particles and X-rays have been studied. During one of the flights on December 17, 1971 a moderate geomagnetic storm occurred when the balloon was floating at a ceiling altitude of approximately 3mb. Marked changes in the measured particle flux were observed in association with the changes in the magnetic field. Observational results are discussed in relation to observations made on April 6, 1972 during a magnetically quiet period. Author

N74-18955+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
VLF PROPAGATION EFFECTS ASSOCIATED WITH MAGNETIC STORMS ON A TRANSEQUATORIAL PATH PASSING THROUGH BRAZILIAN MAGNETIC ANOMALY
Y. Sahai and D. B. Rai Mar. 1973 14 p refs
(INPE-316-RI/099) Avail: NTIS

The amplitude and phase records of VLF singals for NAA (Cutler, Maine) - Sao Jose dos Campos, Brazil propagation path

obtained during the magnetic storms of March 8 and 9, 1970 and August 4 and 5, 1972 are presented and discussed. The night-time records following both the magnetic storms show high correlation with magnetic activity and are similar in nature to those obtained over high latitude paths during auroral disturbances. It is believed that these effects are associated with enhanced particle precipitation in the region of the Brazilian magnetic anomaly during the magnetic storms, since a part of the path lies in the region of the anomaly. The spatial and temporal variations of the ionization in the lower ionosphere, occurring during the storm are believed to be responsible for the anomalous amplitude and phase variations through the mechanism of mode conversion. Author

N74-18956+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INFRARED FLUX DIVERGENCE IN A CLEAR TROPICAL SOUTHERN ATMOSPHERE
Y. Viswanadham Aug. 1972 26 p refs
(Proj. MESA)
(INPE-223-RI/024) Avail: NTIS HC $4.50

Studies of various infrared fluxes at the surface and radiative cooling profiles for clear sky conditions computed at a tropical southern station, Sao Jose dos Campos (23.3 S, 45.8 W), Brazil are presented. It is found that the outgoing long-wave radiation at the surface registers a relative maximum in the summer month of December. On the average, cooling rates are higher in the lower layers, and again in the middle troposphere. Maximum cooling of the order of 3.5 C/day at the surface layer and minimum cooling 0.5 C/day in the upper troposphere are noticed. The results are compared with the findings of other investigators. Author

N74-18957+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ATMOSPHERIC SODIUM MEASUREMENTS AT 23 DEG S
V. W. J. H. Kirchhoff and B. R. Clemesha Aug. 1972 15 p refs
(Proj. MIRO 2)
(INPE-228-RI/028) Avail: NTIS HC $4.00

Measurements of the nighttime atmospheric sodium layer were made over a period of four months at Sao Jose dos Campos (23 deg S, 46 deg W), using the laser radar technique. Peak sodium concentration is found at a height of 95 km and the topside scale height of the layer is usually less than 2 km. On six occasions a secondary peak has been observed at heights between 100 and 105 km. Detailed structure in the layer is frequently conserved from night to night; it is suggested that such structure may be the result of atmospheric tidal oscillations. Laser measurements made about 40 minutes after sunset in the sodium layer, show a decrease of about 30% in the atmospheric sodium, compared with twilight measurements of the total abundance. Author

N74-18958*# Inter-American Geodetic Survey, Fort Clayton (Canal Zone).
CARTOGRAPHIC EXPERIMENT FOR LATIN AMERICA Progress Report, 1 Aug. 1973 - 28 Feb. 1974
Jack E. Staples, Principal Investigator 28 Feb. 1974 30 p
Original contains imagery. Orginal photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4651-B)
(E74-10349; NASA-CR-136957) Avail: NTIS $4.50 CSCL 08B

The author has identified the following significant results. The two experiments clearly demonstrate the practical application of the Skylab photography to update existing maps at an optimum scale of 1:100,000. The photography can even be used, by employing first order photogrammetric instruments, for updating the cultural features in 1:50,000 scale mapping. The S190A imagery has also shown itself to be most economical in preparing new photomap products over previously unmapped areas, such as Concepcion, Paraguay. These maps indicate that Skylab quality imagery is invaluable to the Latin American cartographers in their efforts to provide the mapping products required to develop their countries. In Latin America, where over 5,000 people are employed in map production and where the Latin American governments are expending over $20 million in this effort, the use of such systems to maintain existing mapping and publish new mapping over previously unmapped areas, is of great economic value and could release the conventional Latin American mapping resources to be utilized to produce large scale 1:25,000 and 1:1,000 scale mapping that is needed for specific development projects.

N74-18959*# South Dakota State Univ., Brookings. Remote Sensing Inst.
[DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL] Monthly Report, period ending 1 Mar. 1974
Victor I. Myers, Principal Investigator 1 Mar. 1974 2 p EREP
(Contract NAS9-13337)
(E74-10350; NASA-CR-137035) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N74-18960*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Feb. 1974
Paul M. Merifield, Principal Investigator 5 Mar. 1974 2 p EREP
(Contract NAS2-7698)
(E74-10351; NASA-CR-137036; MPR-9) Avail: NTIS HC $4.00 CSCL 08E

There are no author-identified significant results in this report.

N74-18961*# Department of Agriculture, Washington, D.C. Research and Development Branch.
CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING ERTS IMAGERY Progress Report, 20 Dec. 1973 - 19 Feb. 1974
Donald H. VonSteen, Principal Investigator 19 Feb. 1974 9 p ERTS
(NASA Order S-70251-AG-3)
(E74-10352; NASA-CR-137037) Avail: NTIS HC $4.00 CSCL 02C

There are no author-identified significant results in this report.

N74-18962*# Boeing Co., Kent, Wash.
QUANTITATIVE DETERMINATION OF STRATOSPHERIC AEROSOL CHARACTERISTICS Monthly Report, Feb. 1974
David L. Tingey, Principal Investigator Feb. 1974 1 p EREP
(Contract NAS9-13303)
(E74-10353; NASA-CR-137038) Avail: NTIS HC $4.00 CSCL 04A

There are no author-identified significant results in this report.

N74-18963*# National Marine Fisheries Service, Bay Saint Louis, Miss.
APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Monthly Progress Report, 10 Feb. - 10 Mar. 1974
Kenneth J. Savastano, Principal Investigator 11 Mar. 1974 4 p EREP
(Contract NASA Order T-8217-B)
(E74-10354; NASA-CR-137039; MPR-10) Avail: NTIS HC $4.00 CSCL 08A

There are no author-identified significant results in this report.

N74-18964*# Geological Survey, Reston, Va. Geographic Applications Program.
URBAN AND REGIONAL LAND USE ANALYSIS: CARETS AND CENSUS CITIES EXPERIMENT PACKAGE Monthly Progress Report, Dec. 1973
Robert H. Alexander, Principal Investigator 20 Dec. 1973 7 p EREP

(NASA Order T-5290-B)
(E74-10355, NASA-CR-137040) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. The arrival of the so-called energy crisis makes the portion of this experiment dealing with land use climatology of more immediate significance than before, since in addition to helping to understand the processes of climatic change associated with urbanization, the knowledge obtained may be useful in assigning an energy balance impact factor to proposed changes in land use in and around cities. Thermal maps derived from S-192 data are to be used as a measure of the energy being radiated into space from the mosaic of different surfaces in and around the city. While presenting excellent spatial sampling potential for a metropolitan area tests site, the Skylab data permit a very poor temporal sampling opportunity, owing to the large number of factors beyond the investigator's control that determine when data will be taken over a given test site. The strategy is to augment the thermal maps derived from S-192 with a modeling technique which enables the simulation of a number of components of the surface energy balance, calculated at regular time intervals throughout the day or year. Preliminary tests on the performance of the model are still underway, using airborne MSS data from NASA aircraft flights. Results look extremely promising.

N74-18965*# Naval Research Lab., Washington, D.C.
TERRAIN PROPERTIES AND TOPOGRAPHY FROM SKYLAB ALTIMETRY Monthly Progress Report, Jan. 1974
Allan Shapiro, Principal Investigator 5 Mar. 1974 2 p EREP
(NASA Order T-4716-B)
(E74-10356; NASA-CR-137041) Avail: NTIS HC $4.00 CSCL 08E

There are no author-identified significant results in this report.

N74-18966*# Environmental Research Inst. of Michigan, Ann Arbor.
A SKYLAB PROGRAM FOR THE INTERNATIONAL HYDROLOGICAL DECADE (IHD) Quarterly Report, Jun. - Aug. 1973
Fabian C. Polcyn and Thomas W. Wagner, Principal Investigators 6 Mar. 1974 3 p EREP
(Contract NAS9-13275)
(E74-10357; NASA-CR-137042; ERIM-102300-6-L; QR-2) Avail: NTIS HC $4.00 CSCL 08H

There are no author-identified significant results in this report.

N74-18967*# Environmental Research Inst. of Michigan, Ann Arbor.
A SKYLAB PROGRAM FOR THE INTERNATIONAL HYDROLOGICAL DECADE (IHD) Quarterly Report, Sep. - Nov. 1973
Fabian C. Polcyn and Thomas W. Wagner, Principal Investigators 6 Mar. 1974 5 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13275)
(E74-10358; NASA-CR-137043; ERIM-102300-7-L; QR-3) Avail: NTIS HC $4.00 CSCL 08H

There are no author-identified significant results in this report.

N74-18968*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Progress Report, Feb. 1974
Irvin J. Sattinger, Principal Investigator 7 Mar. 1974 2 p EREP
(Contract NAS9-13283)
(E74-10359; NASA-CR-137044; ERIM-103300-20-L) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-18969*# Maine State Highway Dept., Bangor.
MULTIDISCIPLINARY ANALYSIS FOR HIGHWAY ENGINEERING PURPOSES Progress Report
Ernest G. Stoeckeler and Raymond G. Woodman, Principal Investigators 15 Mar. 1974 2 p EREP
(Contract NAS9-13359)
(E74-10360; NASA-CR-137045; PR-1) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-18970*# Battelle Columbus Labs., Ohio.
CALIBRATION AND EVALUATION OF SKYLAB ALTIMETRY FOR GEODETIC DETERMINATION OF THE GEOID Progress Report, 1-28 Feb. 1974
A. G. Mourad and D. M. J. Fubara, Principal Investigators 15 Mar. 1974 34 p refs EREP
(Contract NAS9-13276)
(E74-10361; NASA-CR-137046; PR-12) Avail: NTIS HC $4.75 CSCL 08E

The author has identified the following significant results. The analysis was based on a time series intrinsic relationship between the satellite ephemeris, altimeter measured ranges, and the corresponding a priori values of subsatellite geoidal heights. Using, least squares processing with parameter weighting, the objective was to recover: (1) the absolute geoidal heights of the subsatellite points; and (2) the associated altimeter calibration constants. Preliminary results from Skylab mission SL-2 are given, using various combinations from two sets of orbit ephemeris and altimeter ranges. It is shown that correctly scaled geoidal heights cannot be deduced by merely subtracting the altimeter range from the geodetic height of the satellite unless the satellite ephemeris and the altimeter have no unknown significant systematic errors or biases and drifts. It is emphasized that the primary objective of the Skylab altimeter is to determine the instrument feasibility. Any additional applications of the data such as for geodesy, geophysics, and oceanography are desirable. Although accurate orbit is required for such applications, it is not a prerequisite for determining the instrument feasibility.

N74-18971*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
KANSAS ENVIRONMENTAL AND RESOURCE STUDY: A GREAT PLAINS MODEL. EXTRACTION OF AGRICULTURAL STATISTICS FROM ERTS-1 DATA OF KANSAS Final Report, 1 Aug. 1972 - 12 Feb. 1974
S. A. Morain, Principal Investigator and Donald L. Williams 12 Feb. 1974 61 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21822)
(E74-10362; NASA-CR-137047) Avail: NTIS HC $6.25 CSCL 08F

The author has identified the following significant results. Wheat area, yield, and production statistics as derived from satellite image analysis, combined with a weather model, are presented for a ten county area in southwest Kansas. The data (representing the 1972-73 crop year) are compared for accuracy against both the USDA August estimate and its final (official) tabulation. The area estimates from imagery for both dryland and irrigated winter wheat were within 5% of the official figures for the same area, and predated them by almost one year. Yield on dryland wheat was estimated by the Thompson weather model to within 0.1% of the observed yield. A combined irrigated and dryland wheat production estimate for the ten county area was completed in July, 1973 and was within 1% of the production reported by USDA in February, 1974.

N74-18972*# New York State Museum and Science Service, Albany.
EVALUATION OF ERTS-1 IMAGERY FOR SPECTRAL GEOLOGICAL MAPPING IN DIVERSE TERRANES OF NEW YORK STATE Progress Report, Jun. 1972 - May 1973
Yngvar W. Isachsen, Principal Investigator, Robert H. Fakundiny, and Stephen W. Forster 29 Jun. 1973 84 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21764)
(E74-10363; NASA-CR-137058) Avail: NTIS HC $7.25 CSCL 08G

The author has identified the following significant results. Linear anomalies dominate the new geological information derived from ERTS-1 imagery, total lengths now exceeding 6000 km. Experimentation with a variety of viewing techniques suggest that conventional photogeologic analyses of band 7 results in the location of more than 97 percent of all linears found. Bedrock lithologic types are distinguishable only where they are topographically expressed or govern land use signatures. The maxima on rose diagrams for ERTS-1 anomalies correspond well with those for mapped faults and topographic lineaments. A multiscale analysis of linears showed that single topographic linears at 1:2,500,000 became dashed linears at 1:1,000,000 aligned zones of shorter parallel, en echelon, or conjugate linears at 1:500,00. Most circular features found were explained away by U-2 airphoto analysis but several remain as anomalies. Visible glacial features include individual drumlins, best seen in winter imagery, drumlinoids, eskers, ice-marginal drainage channels, glacial lake shorelines and sand plains, and end moraines.

N74-18973*# Michigan State Univ., East Lansing.
INVESTIGATION OF SKYLAB DATA Monthly Plans and Progress Report, Feb. 1974
Lester V. Manderscheid, Principal Investigator Feb. 1974 3 p EREP
(Contract NAS9-13332)
(E74-10364; NASA-CR-137051) Avail: NTIS HC $4.00 CSCL 05B

There are no author-identified significant results in this report.

N74-18974*# General Electric Co., Philadelphia, Pa.
APPLICATION OF EARTH RESOURCES TECHNOLOGY SATELLITE DATA TO URBAN DEVELOPMENT AND REGIONAL PLANNING: TEST SITE - COUNTY OF LOS ANGELES Progress Report, Jul. - Aug. 1973
Surendra Raje, Principal Investigator, Richard Economy, Jene McKnight (Los Angeles County Regional Planning Comm.), Monir Sefain (Los Angeles County Regional Planning Comm.), Darryl Goehring (Los Angeles County Regional Planning Comm.), and Gerald Willoughby (OVAAC 8 Intern., Inc.) Sep. 1973 9 p ERTS
(Contract NAS5-21797)
(E74-10365; NASA-CR-137059) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-18975*# Earth Satellite Corp., Berkeley, Calif. 08b
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Plans and Progress Report, 1-28 Feb. 1974
Charles E. Poulton, Principal Investigator 28 Feb. 1974 8 p EREP
(Contract NAS9-13286)
(E74-10366; NASA-CR-137060; MPR-13) Avail: NTIS HC $4.00

There are no author-identified significant results in this report.

N74-18976*# Iowa State Univ. of Science and Technology, Ames. Agriculture Experiment Station.
REMOTE SENSING IN IOWA AGRICULTURE: IDENTIFICATION AND CLASSIFICATION OF IOWA'S CROPS, SOILS AND FORESTRY RESOURCES USING ERTS-1 AND COMPLIMENTARY UNDERFLIGHT IMAGERY Progress Report, period ending Feb. 1974
J. P. Mahlstede, Principal Investigator, R. E. Carlson, T. E. Fenton, and G. W. Thomson 28 Feb. 1974 22 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21839)
(E74-10367; NASA-CR-137061) Avail: NTIS HC $4.25 CSCL 08F

The author has identified the following significant results. Springtime ERTS-1 imagery covering pre-selected test sites in Iowa showed considerable detail with respect to broad soil and land use patterns. Additional imagery has been incorporated into a state mosaic. The mosaic was used as a base for soil association lines transferred from an existing map. The regions of greatest contrast are between the Clarion-Nicollet-Webster soil association area and adjacent areas. Landscape characteristics in this area result in land use patterns with a high percentage of pasture, hay, and timber. The soil association areas of the state that have patterns interpreted to be associated with intensive row crop production are: Moody, Galva-Primghar-Sac, Clarion-Nicollet-Webter, Tama-Muscatine, Dinsdale-Tama, Cresco-Lourdes, Clyde, Kenyon-Floyd-Clyde, and the Luton-Onawa-Salix area on the Missouri River floodplain. Forestland estimates have been attained for an area in central Iowa using wintertime ERTS-1 imagery. Visual analysis of multispectral, temporal imagery indicates that temporal analysis for cropland identification and acreage analyses procedures may be a very useful tool. Combinations of wintertime, springtime, and summertime ERTS-1 imagery separate most vegetation types. Timing can be critical depending upon crop development and harvesting times because of the dynamic nature of agricultural production.

N74-18977*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
REMOTE SENSING OF OCEAN CURRENT BOUNDARY LAYER Monthly Report, Feb. 1974
George A. Maul, Principal Investigator Feb. 1974 3 p EREP
(NASA Order T-4713-B)
(E74-10368; NASA-CR-137062; MPR-8) Avail: NTIS HC $4.00 CSCL 08J

There are no author-identified significant results in this report.

N74-18978*# Boeing Co., Kent, Wash.
QUANTITATIVE DETERMINATION OF STRATOSPHERIC AEROSOL CHARACTERISTICS Monthly Report, Dec. 1973
David L. Tingey, Principal Investigator Dec. 1973 1 p EREP
(Contract NAS9-13303)
(E74-10369; NASA-CR-137063) Avail: NTIS HC $4.00 CSCL 04A

There are no author-identified significant results in this report.

N74-18979*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
INVENTORY OF FOREST AND RANGELAND RESOURCES, INCLUDING FOREST STRESS Monthly Progress Report, 16 Jan. - 15 Mar. 1974
Robert C. Heller, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 15 Mar. 1974 8 p ref ERTS
(NASA Order T-4106-B)
(E74-10370; NASA-CR-137067; MPR-10) Avail: NTIS HC $4.00 CSCL 02F

There are no author-identified significant results in this report.

N74-18980*# Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Feb. 1974
Richard F. Nalepka and William A. Malila, Principal Investigators 14 Mar. 1974 2 p EREP
(Contract NAS9-13280)
(E74-10371; NASA-CR-137068; ERIM-101900-26-L; MPR-12) Avail: NTIS HC $4.00 CSCL 05B

There are no author-identified significant results in this report.

N74-18981*# Minnesota State Planning Agency, St. Paul.
LAND USE MANAGEMENT IN MINNESOTA Progress Report, 1 Jan. - 28 Feb. 1974
Joseph E. Sizer, Principal Investigator 28 Feb. 1974 3 p ERTS
(Contract NAS5-21801)
(E74-10372; NASA-CR-137069) Avail: NTIS HC $4.00 CSCL

08B

There are no author-identified significant results in this report.

N74-18982*# Environmental Research Inst. of Michigan, Ann Arbor.

THIRTEEN CATEGORY RECOGNITION MAP OF YELLOWSTONE NATIONAL PARK PRODUCED FROM ERTS-1 MSS DATA

F. Thomson, Principal Investigator, N. Roller, Harry Smedes (USGS), Ralph Root (Natl. Park Serv.), and Don DeSpain (Natl. Park Serv.) 25 Mar. 1974 4 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21783)

(E74-10373; NASA-CR-137070; ERIM-193300-43-L) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-18983*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.

ERTS-1: AUTOMATED LAND-USE MAPPING IN LAKE WATERSHEDS Special Report

Phillip E. Chase, Principal Investigator, Robert H. Rogers, Larry E. Reed, and V. Elliot Smith (Cranbrook Inst. of Tech.) Mar. 1974 24 p refs ERTS

(Contract NAS5-21810)

(E74-10374; NASA-CR-137071) Avail: NTIS HC $4.25 CSCL 08B

The author has identified the following significant results. ERTS-1 computer compatible tapes were used as a basis to generate land use maps in lake watersheds in southeastern Michigan. These maps, generated on a repetitive basis, provide information essential to governmental agencies concerned with planning and control of lake eutrophication. The ERTS mapping products included geometrically current land use map overlays at 1:250,000 and 1:48,000 scale and area measurement printouts. The printouts provide, within the watershed boundaries and by land use category, a quantitative measure of the amount of land, in square kilometers and acres. This quantitative measure of land use in watersheds is essential to the development and application of deterministic models, which compute nutrient flows into lakes and establish lake eutrophication rates.

N74-18984*# Prescott College, Ariz.

THE HYDROLOGY OF PREHISTORIC FARMING SYSTEMS IN A CENTRAL ARIZONA ECOTONE Quarterly Report, 1 Jan. - 31 Mar. 1974

George J. Gumerman, Principal Investigator 25 Mar. 1974 5 p EREP

(Contract NAS9-13342)

(E74-10375; NASA-CR-137072) Avail: NTIS HC $4.00 CSCL 08H

There are no author-identified significant results in this report.

N74-18985*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Feb. 1974

Roger M. Hoffer, Principal Investigator Feb. 1974 5 p EREP (Contract NAS9-13380)

(E74-10376; NASA-CR-137073) Avail: NTIS HC $4.00 CSCL 08F

The author has identified the following significant results. One capability which has been recognized by many geologists working with space photography is the ability to see linear features and alinements which were previously not apparent. To the exploration geologist, major lineaments seen on satellite images are of particular interest. A portion of ERTS-1 frame 1407-17193 (3 Sept. 1973) was used for mapping lineaments and producing an iso-lineament intersection map. Skylab photography over the area of prime area was not useable due to snow cover. Once the lineaments were mapped, a grid with 2.5 km spacing was overlayed on the map and the lineament intersections occurring within each grid square were counted and the number plotted in the center of the grid square. These numbers were then contoured producing a contour map of equal lineament intersection. It is believed that the areas of high intersection concentration would be the most favorable area for ore mineralization if favorable host rocks are also present. These highly fractured areas would act as conduits for carrying the ore forming solutions to the site of deposition in a favorable host rock. Two of the six areas of high intersection concentration are over areas of present or past mining camps and small claims are known to exist near the others. These would be prime target areas for future mineral exploration.

N74-18986*# Service de la Carte de la Vegetation CNRS, Toulouse (France).

MANAGEMENT OF NATURAL RESOURCES THROUGH AUTOMATIC CARTOGRAPHIC INVENTORY Progress Report, Feb. - Dec. 1973

P.-A. Rey, Yves Gourinard, Francis Cambou, Principal Investigators, J. C. Guyader, P. Gouaux, T. LeToan, M. Monchant, B. Donville, and D. Loubet Dec. 1973 87 p refs Sponsored by NASA Original contains imagery. Original photography may by be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E74-10377; NASA-CR-137162; PR-2) Avail: NTIS HC $7.50 CSCL 08B

The author has identified the following significant results. Significant results of the ARNICA program (February - December 1973) were: (1) The quantitative processing of ERTS-1 data was developed along two lines: the study of geological structures and lineaments of Spanish Catalonia, and the phytogeographical study of the forest region of the Landes of Gascony (France). In both cases it is shown that the ERTS-1 imagery can be used in establishing zonings of equal quantitative interpretation value. (2) In keeping with the operational transfer program proposed in previous reports between exploration of the imagery and charting of the object, a precise data processing method was developed, concerning more particularly the selection of digital equidensity samples computer display and rigorous referencing.

N74-18987*# Service de la Carte de la Vegetation CNRS, Toulouse (France).

MANAGEMENT OF NATURAL RESOURCES THROUGH AUTOMATIC CARTOGRAPHIC INVENTORY Progress Report, Apr. - Dec. 1973

P.-A. Rey, Yves Gourinard, and Francis Cambou, Principal Investigators Jan. 1974 37 p refs Sponsored by NASA ERTS

(E74-10378; NASA-CR-137163; PR-3) Avail: NTIS HC $5.00 CSCL 08B

The author has identified the following significant results. (1) Accurate recognition of previously known ground features from ERTS-1 imagery has been confirmed and a probable detection range for the major signatures can be given. (2) Unidentified elements, however, must be decoded by means of the equal densitometric value zone method. (3) Determination of these zonings involves an analogical treatment of images using the color equidensity methods (pseudo-color), color composites and especially temporal color composite (repetitive superposition). (4) After this analogical preparation, the digital equidensities can be processed by computer in the four MSS bands, according to a series of transfer operations from imagery and automatic cartography.

N74-18988*# Geological Survey, Tucson, Ariz.

DYNAMICS OF DISTRIBUTION AND DENSITY OF PHREATOPHYTES AND OTHER ARID-LAND PLANT COMMUNITIES Progress Report, 1 Jul. - 31 Aug. 1973

Raymond M. Turner, Principal Investigator 12 Feb. 1974 2 p ERTS

(NASA Order S-70243-AG-2)

(E74-10379; NASA-CR-137164) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N74-18989*# Geological Survey, Reston, Va.
IRON-ABSORPTION BAND ANALYSIS FOR THE DISCRIMINATION OF IRON-RICH ZONES Progress Report, 1 Jul. - 31 Dec. 1973
Lawrence C. Rowan, Principal Investigator 30 Jan. 1974 11 p refs ERTS
(NASA Order S-70243-AG-4)
(E74-10380; NASA-CR-137165) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. Most major rock units and unaltered and altered areas in the study area can be discriminated on the basis of visible and near-infrared spectral reflectivity differences recorded from satellite altitude. These subtle spectral differences are detectable by digital ratioing of the MSS bands and subsequent stretching to increase the contrast to enhance spectral differences. Hydrothermally altered areas appear as anomalous color patches within the volcanic-rock areas. A map has been prepared which can be regarded as an excellent reconnaissance exploration map, for use in targeting areas for more detailed geological, geochemical, and geophysical studies. Mafic and felsic rock types are easily discriminated on the color stretched-ratio composite. The ratioing process minimizes albedo effects, leaving only the recorded characteristic spectral response. The spectra of unaltered rocks appear different from those of altered rocks, which are typically dominated by limonite and clay minerals. It seems clear that differences in spectral shape can provide a basis for discrimination of geologic material, although the relations between visible and near-infrared spectral reflectivity and mineralogical composition are not yet entirely understood.

N74-18990*# Geological Survey, Reston, Va.
INVESTIGATION OF ERTS/RBV AND MSS IMAGERY FOR PHOTOMAPPING OF THE UNITED STATES Progress Report, 1 Jul. - 31 Dec. 1973
Joseph T. Pilonero, Principal Investigator 1 Jan. 1974 3 p ERTS
(NASA Order S-70243-AG)
(E74-10381; NASA-CR-137166) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-18991*# Geological Survey, Reston, Va. Geographic Applications Program.
LAND USE MAPPING AND MODELLING FOR THE PHOENIX QUADRANGLE Progress Report, 1 Jul. - 31 Dec. 1973
John L. Place, Principal Investigator 1 Jan. 1974 5 p ERTS
(NASA Order S-70243-AG)
(E74-10382; NASA-CR-137167) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. Changes in the land use in the Phoenix (1:250,000 scale) Quadrangle in Arizona have been mapped using only the images from ERTS-1, tending to verify the utility of a land use classification system proposed for use with ERTS images. Seasonal changes were studied on successive ERTS-1 images, particularly large scale color composite transparencies for August, October, February, and May, and this seasonal variation aided delineation of land use boundaries. Types of equipment used to aid interpretation included color additive viewer, a twenty-power magnifier, a density slicer, and a diazo copy machine. A Zoom Transfer Scope was used for scale and photogrammetric adjustments. Types of changes detected have been: (1) cropland or rangeland developed as new residential areas; (2) rangeland converted to new cropland or to new reservoirs; and (3) possibly new activity by the mining industries. A map of land use previously compiled from air photos was updated in this manner. ERTS-1 images complemented air photos: the photos gave detail on a one-shot basis; the ERTS-1 images provided currency and revealed seasonal variation in vegetation which aided interpretation of land use.

N74-18992*# Geological Survey, Reston, Va.
THE CARTOGRAPHIC APPLICATION OF ERTS/RBV IMAGERY IN POLAR REGIONS Progress Report, 1 Jul. - 31 Dec. 1973
William R. MacDonald, Principal Investigator 1 Jan. 1974 4 p ERTS
(NASA Order S-70243-AG-2)
(E74-10383; NASA-CR-137168) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-18993*# Geological Survey, Tucson, Ariz.
DYNAMICS OF DISTRIBUTION AND DENSITY OF PHREATOPHYTES AND OTHER ARID-LAND PLANT COMMUNITIES Progress Report, 1 Sep. - 30 Oct. 1973
Raymond M. Turner, Principal Investigator 12 Feb. 1974 2 p ERTS
(NASA Order S-70243-AG-2)
(E74-10384; NASA-CR-137169) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N74-18994*# Geological Survey, Reston, Va.
SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND Progress Report, 1 Sep. - 31 Oct. 1973
Richard S. Williams, Jr., Principal Investigator 1 Nov. 1973 8 p refs Sponsored by NASA ERTS
(E74-10385; NASA-CR-137170) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. Rhyolitic rocks in the Torfajokull geothermal area and geothermally altered ground in the Torfajokull and Reykjanes geothermal areas can also be delineated. The fallout pattern of tephra from the 1970 eruption from the volcano Hekla can be mapped where sufficient depth of deposition destroyed the vegetation. Standard NDPF 70mm negatives (3rd generation) were used to print enlargements of the volcanic islands of Surtsey and Heimaey. Sufficient resolution is maintained to directly update maps to the 1:100,000 scale. Low-sun angle imagery (< 10 deg) of Iceland has been particularly valuable in mapping new structural and volcanic features hidden beneath glacialic ice in Iceland's neovolcanic zone. ERTS-1 imagery has shown the marked differences in volcanic landforms in Iceland from a regional viewpoint. The regional distribution of crater rows, moberg ridges, table (moberg) mountains, calderas, central volcanoes, and shield volcanoes shows striking differences in volcanic geomorphology in different parts of Iceland's neovolcanic zone.

N74-18995*# Stanford Univ., Calif. School of Earth Sciences.
MULTISPECTRAL SIGNATURES IN RELATION TO GROUND CONTROL SIGNATURE USING NESTED SAMPLING APPROACH Progress Report, 3 Jan. - 3 Mar. 1974
R. J. P. Lyon and F. R. Honey, Principal Investigators 3 Mar. 1974 28 p ERTS
(Contract NAS5-21884)
(E74-10386; NASA-CR-137204) Avail: NTIS HC $4.50 CSCL 05B

There are no author-identified significant results in this report.

N74-18996*# Boeing Co., Kent, Wash.
QUANTITATIVE DETERMINATION OF STRATOSPHERIC AEROSOL CHARACTERISTICS Monthly Report, Nov. 1973
David L. Tingey, Principal Investigator Nov. 1973 1 p EREP
(Contract NAS9-13303)
(E74-10387; NASA-CR-137205) Avail: NTIS HC $4.00 CSCL 04A

There are no author-identified significant results in this report.

N74-18997*# South Dakota State Univ., Brookings. Remote Sensing Inst.
[DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL] Monthly Report, period ending 1 Dec. 1973
Victor I. Myers, Principal Investigator 1 Dec. 1973 2 p EREP
(Contract NAS9-13337)

(E74-10388; NASA-CR-137206) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N74-18998*# Texas Univ., Austin.
A HYDROGEOMORPHIC APPROACH TO EVALUATING FLOOD POTENTIAL IN CENTRAL TEXAS FROM ORBITAL AND SUBORBITAL REMOTE SENSING IMAGERY
Victor R. Baker, Principal Investigator, Robert K. Holz, and Steven D. Hulke [1974] 2 p EREP
(Contract NAS9-13312)
(E74-10389; NASA-CR-137207) Avail: NTIS HC $4.00 CSCL 08H

There are no author-identified significant results in this report.

N74-18999*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO Progress Report, 1 Feb. - 31 Mar. 1974
Daniel H. Knepper, Jr., Principal Investigator 29 Mar. 1974 3 p ERTS
(Contract NAS5-21778)
(E74-10390; NASA-CR-137208) Avail: NTIS HC $4.00 CSCL 08G

There are no author-identified significant results in this report.

N74-19000*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF ERTS-1 DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT Progress Report, period ending 28 Feb. 1974
Roland S. Yunghans, Edward B. Feinberg, Frank J. Wobber, Robert L. Mairs, Principal Investigators, Robert T. Macomber, Dennis Stanczuk, and JoAnn Stitt 19 Mar. 1974 5 p Prepared for N. J. Dept. of Environ. Protect. ERTS
(Contract NAS5-21765)
(E74-10391; NASA-CR-137209) Avail: NTIS HC $4.00 CSCL 08A

The author has identified the following significant results. Rapid access to ERTS data was provided by NASA GSFC for the February 26, 1974 overpass of the New Jersey test site. Forty-seven hours following the overpass computer-compatible tapes were ready for processing at EarthSat. The finished product was ready just 60 hours following the overpass and delivered to the New Jersey Department of Environmental Protection. This operational demonstration has been successful in convincing NJDEP as to the worth of ERTS as an operational monitoring and enforcement tool of significant value to the State. An erosion/ accretion severity index has been developed for the New Jersey shore case study area. Computerized analysis techniques have been used for monitoring offshore waste disposal dumping locations, drift vectors, and dispersion rates in the New York Bight area. A computer shade print of the area was used to identify intensity levels of acid waste. A Litton intensity slice print was made to provide graphic presentation of dispersion characteristics and the dump extent. Continued monitoring will lead to the recommendation and justification of permanent dumping sites which pose no threat to water quality in nearshore environments.

N74-19001*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Monthly Progress Report, Feb. 1974
Keenan Lee, Principal Investigator 22 Mar. 1974 8 p EREP
(Contract NAS9-13394)
(E74-10392; NASA-CR-137210) Avail: NTIS HC $4.00 CSCL 08G

There are no author-identified significant results in this report.

N74-19002*# Michigan State Univ., East Lansing.
USE OF ERTS DATA FOR A MULTIDISCIPLINARY ANALYSIS OF MICHIGAN RESOURCES Progress Report
Axel L. Andersen, Wayne Myers, Gene Safir, and E. P. Whiteside, Principal Investigators 21 Mar. 1974 20 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21834)
(E74-10393; NASA-CR-137211; PR-3) Avail: NTIS HC $4.00 CSCL 08F

The author has identified the following significant results. The results of this investigation of ratioing simulated ERTS spectral bands and several non-ERTS bands (all collected by an airborne multispectral scanner) indicate that significant terrain information is available from band-ratio images. Ratio images, which are based on the relative spectral changes which occur from one band to another, are useful for enhancing differences and aiding the image interpreter in identifying and mapping the distribution of such terrain elements as seedling crops, all bare soil, organic soil, mineral soil, forest and woodlots, and marsh areas. In addition, the ratio technique may be useful for computer processing to obtain recognition images of large areas at lower costs than with statistical decision rules. The results of this study of ratio processing of aircraft MSS data will be useful for future processing and evaluation of ERTS-1 data for soil and landform studies. Additionally, the results of ratioing spectral bands other than those currently collected by ERTS-1 suggests that some other bands (particularly a thermal band) would be useful in future satellites.

N74-19003*# Environmental Research Inst. of Michigan, Ann Arbor.
OIL POLLUTION DETECTION, MONITORING AND LAW ENFORCEMENT Quarterly Progress Report
Robert Horvath, Principal Investigator 20 Mar. 1974 2 p EREP
(Contract NAS9-13281)
(E74-10394; NASA-CR-137212; ERIM-101800-10-L) Avail: NTIS HC $4.00 CSCL 08J

There are no author-identified significant results in this report.

N74-19004*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
IN SITU SPECTRORADIOMETRIC CALIBRATION OF EREP IMAGERY AND OCEANOGRAPHY OF BLOCK ISLAND SOUND Monthly Progress Report, Mar. 1974
E. Yost, Principal Investigator 20 Mar. 1974 4 p EREP
(Contract NAS9-13308)
(E74-10396; NASA-CR-137214) Avail: NTIS HC $4.00 CSCL 08J

There are no author-identified significant results in this report.

N74-19005*# Cornell Univ., Ithaca, N.Y. New York State Coll. of Agriculture and Life Sciences.
EVALUATION OF SKYLAB IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES (SKYLAB) Progress Report, 1-28 Feb. 1974
Ernest E. Hardy, Principal Investigator 28 Jan. 1974 2 p EREP
(Contract NAS9-13364)
(E74-10397; NASA-CR-137215) Avail: NTIS HC $4.00 CSCL 05B

There are no author-identified significant results in this report.

N74-19006*# Geological Survey, Denver, Colo.
A STUDY OF MORPHOLOGY, PROVENANCE, AND MOVEMENT OF DESERT SAND SEAS IN AFRICA, ASIA, AND AUSTRALIA Progress Report, 1 Nov. - 31 Dec. 1973
Edwin D. McKee, Principal Investigator and Carol S. Breed 1 Jan. 1973 12 p refs ERTS
(NASA Order S-70243-AG-4)
(E74-10398; NASA-CR-137123) Avail: NTIS HC $4.00 CSCL 08F

The author has identified the following significant results. Recent acquisition of generally high quality color prints for most of the test sites has enabled the project to make significant advances in preparing mosaics of sand desert areas under study.

Computer enhancement of imagery of selected sites, where details of complex dune forms need to be determined, has been achieved with arrival of computer-compatible ERTS-1 tapes. Further, a comparator, recently received, gives precise visual measurements of width, length, and spacing of sand bodies and so improves comparison of patterns in various test sites. Considerable additional meteorological data recently received on sand-moving winds in China, Pakistan, Libya and other areas enabled much progress to be made in developing overlays for the dune mosaics. These data show direction, speed, and frequency of winds. Other new data for use in preparing overlays used with ERTS-1 image mosaics include ground truth on moisture control, geologic settings, and plant distribution. With the addition of visual observation data and prints from hand-held photography now being obtained by the Skylab mission, much progress in interpreting the patterns of sand seas for 17 desert sites is anticipated.

N74-19007*# Science Applications, Inc., Ann Arbor, Mich.
USE OF SKYLAB EREP DATA IN A SEA SURFACE TEMPERATURE EXPERIMENT Quarterly Report, 17 Nov. 1973 - 17 Feb. 1974
David C. Anding, Principal Investigator and John P. Walker Feb. 1974 31 p refs EREP
(Contract NAS9-13277)
(E74-10399; NASA-CR-137224; JRB-74-201-AA; QR-4) Avail: NTIS HC $4.75 CSCL 08J

There are no author-identified significant results in this report.

N74-19008*# Environmental Research and Technology, Inc., Lexington, Mass.
THE APPLICATION OF ERTS IMAGERY TO MAPPING SNOW COVER IN THE WESTERN UNITED STATES Final Report, 28 Jun. 1972 - 31 Dec. 1973
James C. Barnes, Principal Investigator, Clinton J. Bowley, and David A. Simmes Jan. 1974 80 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21803)
(E74-10400; NASA-CR-137223; ERT-P-407-F) Avail: NTIS HC $7.00 CSCL 08L

The author has identified the following significant results. In much of the western United States a large part of the utilized water comes from accumulated mountain snowpacks; thus, accurate measurements of snow distributions are required for input to streamflow prediction models. The application of ERTS-1 imagery for mapping snow has been evaluated for two geographic areas, the Salt-Verde watershed in central Arizona and the southern Sierra Nevada in California. Techniques have been developed to identify snow and to differentiate between snow and cloud. The snow extent for these two drainage areas has been mapped from the MSS-5 (0.6 - 0.7 microns) imagery and compared with aerial survey snow charts, aircraft photography, and ground-based snow measurements. The results indicate that ERTS imagery has substantial practical applications for snow mapping. Snow extent can be mapped from ERTS-1 imagery in more detail than is depicted on aerial survey snow charts. Moreover, in Arizona and southern California cloud obscuration does not appear to be a serious deterrent to the use of satellite data for snow survey. The costs involved in deriving snow maps from ERTS-1 imagery appear to be very reasonable in comparison with existing data collection methods.

N74-19009*# TRW Systems Group, Redondo Beach, Calif.
EVALUATION OF DIGITAL CORRECTION TECHNIQUES FOR ERTS IMAGES Final Report and Semiannual Progress Report
John E. Taber, Principal Investigator, S. S. Rifman, and D. M. McKinnon Mar. 1974 80 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21814)
(E74-10401; NASA-CR-137225; TRW-20634-6003-TU-00) Avail: NTIS HC $7.00 CSCL 05B

There are no author-identified significant results in this report.

N74-19010*# Cornell Univ., Ithaca, N.Y. New York State Coll. of Agriculture and Life Sciences.
EVALUATION OF SATELLITE IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES (SKYLAB) Progress Report, 1-31 Nov. 1973
Ernest E. Hardy, Principal Investigator and Rodney Wulff 31 Nov. 1973 11 p ref EREP
(Contract NAS9-13364)
(E74-10402; NASA-CR-137226) Avail: NTIS HC $4.00 CSCL 05B

There are no author-identified significant results in this report.

N74-19011*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ANALYSIS OF DATA FROM SPACECRAFT (STRATOSPHERIC WARMINGS) Quarterly Progress Report, Sep. - Nov. 1973
12 Dec. 1973 41 p refs
(Contract NASw-2553)
(NASA-CR-137260; QPR-1; LMSC-D384420) Avail: NTIS HC $5.25 CSCL 04A

Investigations involved a search through existing literature and data to obtain case histories for the six or more stratospheric warmings that occurred in April - May 1969, June - July 1969, August 1969, December 1969 - January 1970 , December 1970 - January 1971, and January 1973 - February 1973. For each of these warmings the following steps have been taken in preparation for analysis: (1) defining the nature of the problem; (2) literature search of stratwarmings and solar-terrestrial phenomens; and (3) file of data sources, especially stratospheric temperatures (radiances) and geophysical indices. Author

N74-19012*# GCA Corp., Bedford, Mass. Technology Div.
OBSERVATIONS OF CHEMICAL RELEASES FROM HIGH FLYING AIRCRAFT Final Report
John F. Bedinger and E. Constantinides Dec. 1973 38 p refs
(Contract NASw-2308)
(NASA-CR-137231; GCA-TR-73-7-N) Avail: NTIS HC $5.00 CSCL 04A

Barium and lithium vapors were released from sounding rockets in the thermosphere and observed from aboard the NASA Convair 990 at an altitude of 40,000 ft. The purpose of the releases was to (1) check out observational and operational procedures associated with the large high altitude barium release from a Scout rocket (BIC); (2) develop an all-weather technique for observing chemical releases; (3) evaluate methods of observing daytime releases, and (4) investigate the possibilities of observations from a manned satellite. The initial analysis indicates that the previous limitations on the usage of the vapor release method have been removed by the use of the aircraft and innovative photographic techniques. Methods of analysis and applications to the investigation of the thermosphere are discussed. Author

N74-19013*# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
MULTISTAGE, MULTIBAND AND SEQUENTIAL IMAGERY TO IDENTIFY AND QUANTIFY NON-FOREST VEGETATION RESOURCES Remote Sensing Applications in Forestry. Final Report
Richard S. Driscoll and Richard C. Francis Berkeley, Calif. Calif. Univ. Forestry Remote Sensing Lab. 30 Sep. 1972 59 p refs Prepared for Calif. Univ., Berkeley. Forestry Remote Sensing Lab.
(NASA Order R-09-038-002)
(NASA-CR-137147) Avail: NTIS HC $6.00 CSCL 08F

Earth Resources photographs from Apollo 6, 7, and 9 and photographs taken during Gemini 4, were used in the research along with high altitude and conventional aerial photography. A unified land use and resource analysis system was devised and used to develop a mapping legend. The natural vegetation, land use, macrorelief, and landforms of northern Maricopa County, Arizona, were analyzed and inventoried. This inventory was interpreted in relation to the critical problem of urban expansion

and agricultural production in the study area. The central thrust of the research program has been to develop methods for use of space and small-scale, high-altitude aerial photography to develop information for land use planning and resource allocation decisions. Author

N74-19014*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Atmospheric Physics Branch.
ANALYSIS OF DATA FROM SPACECRAFT (STRATOSPHERIC WARMINGS) Quarterly Progress Report, Dec. 1973 - Feb. 1974
A. D. Anderson 12 Mar. 1974 54 p refs
(Contract NASw-2553)
(NASA-CR-137257; GCS/3529/6211; APR-2; LMSC-D387326) Avail: NTIS HC $5.75 CSCL 04A

Links between the upper atmosphere and the stratosphere were studied to explain stratospheric warmings, and to correlate the warmings with other terrestrial and solar phenomena. Physical mechanisms for warming, or which may act as a trigger are discussed along with solar and geophysical indices. Two stratospheric warming cases are analyzed. F.O.S.

N74-19015*# Kanner (Leo) Associates, Redwood City, Calif.
A FEW CONSIDERATIONS ON THE ERTS NO. 1 PICTURES OF THE WET PAMPA AREA: THE REPUBLIC OF ARGENTINA
Oscar Dominguez Washington NASA Mar. 1974 14 p Transl. into ENGLISH from the Argentine report
(Contract NASw-2481)
(NASA-TT-F-15451) Avail: NTIS HC $4.00 CSCL 08F

Factors, such as cloud cover and land surface area, which affected the ERTS-1 aerial photographs of the Wet Pampa Area of Argentina are discussed. The advantages and disadvantages of using remote sensing for photography rather than ground-based photography are discussed. A chart is included showing the orbits of ERTS-1 and the number of pictures taken. K.M.M.

N74-19016# Ohio State Univ., Columbus. Dept. of Geodetic Science.
THE OHIO STANDARD BASELINE, 1970.9 Ph.D. Thesis
S. F. Cushman 1972 187 p refs
(Rept-207) Avail: NTIS HC $12.50 CSCL 08E

The establishment of the Ohio Standard Baseline is discussed in terms of site conditions and instrumentation. The calibration of the etalon is detailed. Other topics discussed include: coordinate systems; computing the length of the standard baseline; effects of weather and site soil composition on the accuracy of measurements; air temperature; and compensation. The observations of interference for 1970 are included. K.M.M.

N74-19017*# Techtran Corp., Glen Burnie, Md.
SCATTERING AND ATTENUATION OF ELECTROMAGNETIC RADIATION BY ATMOSPHERIC PARTICLES
V. I. Rozenberg Washington NASA Feb. 1974 345 p refs Transl. into ENGLISH of the book "Rasseyaniye i Oslableniye Elektromagnitnogo Izlucheniya Atmosfernymi Chastitsami" Leningrad, Hydrometeorological Press, 1972 348 p
(Contract NASw-2485)
(NASA-TT-F-771) Avail: NTIS HC $7.50 CSCL 04A

Scattering and attenuation of submillimeter, millimeter and centimeter radio waves by an arbitrary collective of atmospheric particles are discussed. Attention is given to dielectric permeability, radiophysical characteristics, and calculation aspects of algorithms development and computer processing. Author

N74-19018# New Hampshire Univ., Durham. Dept. of Physics.
HYDROMAGNETIC WAVES EXCITED DURING AN SSC
Richard L. Kaufmann and David N. Walker Mar. 1974 30 p refs
(Grant NSF GA-32501X)
Avail: NTIS HC $4.50

Three hydromagnetic perturbations are excited by a storm sudden commencement at 0810 UT on October 28, 1961. The effects of these perturbations are seen in Explorer 12 energetic particle and magnetic field measurements that were made near the equator, and on ground magnetograms. The entire magnetosphere is compressed and energetic particles are accelerated. A 15 gamma compressional hydromagnetic pulse is produced during this sudden compression. Finally, a damped toroidal oscillation is excited. The oscillation, as seen by the satellite, has an initial amplitude of 26 gamma, a period of 248 sec, and a characteristic exponential damping time of 397 sec. A model calculation shows that the observed damping can be produced by finite ionospheric conductivity. Author

N74-19019# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INFORMATION TO THE UNITED NATIONS RELATIVE TO THE BRAZILIAN ERTS FACILITY: COMPOSITION AND COSTS
Fernando Demendonca Apr. 1973 38 p Sponsored by UN
(INPE-322-RI/103) Avail: NTIS HC $5.00

Diagrams and charts describing the ERTS facility in Brazil are presented. The facility is composed of four parts: (1) tracking and receiving stations; (2) image processing station; (3) photographic processing station; and (4) data bank. A cost analysis for building this station is also given. S.K.W.

N74-19020# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UTILIZATION OF SCANNER THERMAL INFRARED DATA IN STUDYING THE WATERSHED MANAGEMENT
Mostafa K. Nosseir May 1973 41 p refs
(Proj. SERE)
(INPE-340-RI/116) Avail: NTIS HC $5.25

The thermal infrared remote sensing techniques are applied to watershed management. Potential evapotranspiration was emphasized for methods depending on the surface temperature energy budget of the targets. Author

N74-19021# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOMETRICAL CONSIDERATIONS OF GEOMAGNETIC FIELD USEFUL TO SATELLITE BEACON STUDIES
N. D. Kaushika and Mohammed Ibrahim Jun. 1972 18 p refs
(Proj. RASA 1)
(INPE-205-RI/006) Avail: NTIS HC $4.00

Geomagnetic field enters the theory of Faraday experiment in terms of a geomagnetic factor which involves the longitudinal component of earth's magnetic field along the ray path from the satellite to the observer. The variations in the geomagnetic factor and magnetic field are studied and applied to the analysis and interpretation of beacon data. The beacon satellites transmit linearly polarized unmodulated waves of frequencies greater than the critical frequency of the inonsphere. Author

N74-19022*# Scientific Translation Service, Santa Barbara, Calif.
OPTICAL INVESTIGATIONS OF THE ATMOSPHERE USING ARTIFICIAL SATELLITES
M. S. Malkevich Washington NASA Mar. 1974 232 p refs Transl. into ENGLISH of the book "Opticheskiye Issledovaniya Atmosfery so Sputnikov" Moscow, Nauka, 1973 p 1-303
(Contract NASw-2483)
(NASA-TT-F-15186) Avail: NTIS HC $14.75 CSCL 04A

Methods of interpretation and results of measurements of the optical characteristics of the earth, obtained by means of artificial satellites with the object of determining the physical parameters of the atmosphere, the clouds, and the earth's surface are discussed. The methods are based on the use of a priori statistical characteristics of the structure of fields of the earth's atmospheric parameters. Methods are presented for solving the problems of determining the temperature of the ground surface, and the temperature and characteristics of the three-dimensional structure of the cloud cover from measurements of radiation in the visible and infrared regions of the spectrum, taken from the satellites Kosmos 149, Kosmos 243 and Kosmos 320. Author

N74-19023*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRIC FIELD MEASUREMENTS ACROSS THE HARANG DISCONTINUITY
Nelson C. Maynard Feb. 1974 41 p refs

(NASA-TM-X-70613; X-625-74-67) Avail: NTIS HC $5.25 CSCL 04A

The Harang discontinuity, the area separating the positive and negative bay regions in the midnight sector of the auroral zone, is a focal point for changes in behavior of many phenomena. Through this region the electric field rotates through the west from a basically northward field in the positive bay region to a basically southward field in the negative bay region, appearing as a reversal in a single axis measurement; 32 of these reversals have been identified in the OGO-6 data from November and December, 1969. The discontinuity is dynamic in nature, moving southward and steepening its latitudinal profile as magnetic activity is increased. As activity decreases it relaxes poleward and spreads out in latitudinal width. It occurs over several hours of magnetic local time. The boundary in the electric field data is consistent with the reversal of ground magnetic disturbances from a positive to negative bay condition. The discontinuity is present in the electric field data both during substorms and during quiet times and appears to define a pattern on which other effects can occur. Author

N74-19024*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ANALYSIS OF IONOSPHERIC REFRACTION ERROR CORRECTIONS FOR GRARR SYSTEMS

A. J. Mallinckrodt, H. C. Parker, and J. H. Berbert Apr. 1971 27 p refs

(NASA-TM-X-70607; X-552-71-170) Avail: NTIS HC $4.50 CSCL 04A

A determination is presented of the ionospheric refraction correction requirements for the Goddard range and range rate (GRARR) S-band, modified S-band, very high frequency (VHF), and modified VHF systems. The relationships within these four systems are analyzed to show that the refraction corrections are the same for all four systems and to clarify the group and phase nature of these corrections. The analysis is simplified by recognizing that the range rate is equivalent to a carrier phase range change measurement. The equation for the range errors are given. Author

N74-19025*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NASA-GSFC IONOSPHERIC CORRECTIONS TO SATELLITE TRACKING DATA

P. E. Schmid, R. B. Bent, S. K. Llewellyn, G. Nesterczuk, and S. Rangaswamy Apr. 1971 46 p refs

(NASA-TM-X-70608; X-591-73-281) Avail: NTIS HC $5.50 CSCL 04A

An overview is presented of the development, verification, and recent implementation of the NASA-GSFC ionospheric model for satellite tracking data corrections. This model was incorporated into the Goddard Trajectory Determination System which is providing continuous trajectory computation support for the lunar orbiting Radio Astronomy Explorer-B launched on 10 June 1973. Author

N74-19026*# Illinois Univ., Urbana. Aeronomy Lab.

ENERGETIC ELECTRONS IN THE MIDLATITUDE NIGHTTIME E REGION

L. G. Smith, M. A. Geller, and H. D. Voss [1973] 23 p refs Submitted for publication

(Grants NGR-14-005-181; NSF GA-25660)

(NASA-CR-137250) Avail: NTIS HC $4.25 CSCL 04A

Nike Apache 14.439 was launched from Wallops Island at 0003 EST on 1 November 1972, a very disturbed night (K sub P = 8). A Geiger counter in the payload detected electrons (> keV) with a maximum flux of 1086 + or -261/sq cm/sec/ster. The height-averaged ionization rate in the upper E region is calculated from the measured electron density profile and has a value of 35 1/cu/cm/sec. The ionization rate can be reconciled with the observed flux of electrons (> 70 2 keV) if the spectrum (> keV) is of the form J (> E) = J sub O exp(-E/E sub O) with E sub O equal to 8.3 keV. The ionization rate on this and other nights is found to be strongly dependent on geomagnetic activity. It is suggested that energetic electrons are the principal source of ionization at midlatitudes in the upper E region near midnight, even under rather quiet geomagnetic conditions. Author

N74-19027# Seismological Central Observatory Graefenberg, Erlangen (West Germany).

SEISMOLOGICAL BULLETIN 1971 OF THE SEISMOLOGICAL STATIONS OF THE FEDERAL REPUBLIC OF GERMANY: BNS, BOC, BRL, BUH, FEL FUR, GRF, HAM, HEI, HLG, HOF, KRL, MSG, MSS, RAV, STU, TNS, TUB

1973 648 p Sponsored by Bundesanstalt fuer Bodenforschung, Hannover

Avail: NTIS HC $35.50

Seismological observations, which include hypocenter and station data are presented. The Hypocenter Data File is composed of CGS preliminary determination of epicenters, the BCIS determination preliminaire, and data reported by German stations and institutions about local earthquakes and commercial explosions. The station data file includes the seismograms readings of the German stations. Author

N74-19028# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).

DUST IN THE UPPER ATMOSPHERE

B. R. Clemesha and Y. Nakamura May 1972 9 p refs

(INPE-201-RI/002) Avail: NTIS HC $4.00

During October 1971 a large influx of dust into the upper atmosphere at heights above 30 km was observed. The magnitude of this influx appears to be considerably greater than anything previously reported. The observations were made using a laser radar with transmitted energy of 3 J in pulses 2 micro seconds long: the repetition rate was 300 (h-1)power, wavelength of the radiation was 0.6943 microns. The receiver had a collecting area of 0.39 sq m, and a bandwidth of 2.0 microns its efficiency was 2%. We first observed excess scattering on October 19; because of bad weather conditions no observations had been made for nearly a month prior to this date. The last profile obtained before the start of the dust influx was on September 22, and that gave a good fit to a standard atmosphere, with only slight deviations, probably caused by a tidal effect. Results of the observations are shown as the ratio of the observed scattering to that expected from a standard atmosphere. Author

N74-19029# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

IONOSPHERIC DISTURBANCES DUE TO AN OCEAN WAVE (TSUNAMI)

Narendra D. Kaushika Mar. 1972 18 p refs

(LAFE-185) Avail: NTIS HC $4.00

The problem of whether or not a tsunami can give rise to an ionospheric disturbance of detectable magnitude is investigated theoretically assuming the symmetric waveform of the tsunami and the simple (isothermal, static and unperturbed) conditions of the atmosphere. Results indicate that the amplitude of ionospheric disturbances created by a tsunami is of the order of magnitude to be detectable experimentally. Author

N74-19030# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

RADARGEOLOGICAL OBSERVATIONS ON THE LOW HILLY TERRAIN AMIDST PIAUI, PERNAMBUCO AND BAHIA STATE, BRAZIL

Liu Chang Chiang Apr. 1973 19 p

(INPE-336-RI/112) Avail: NTIS HC $4.00

The use of SLAR mosaic as a geological tool in mapping the low hilly terrain of Brazil is examined. Only terrain with monotonous Precambrian rocks with similar erosional resistance, lack of characteristic appearance, and poor outcrops due to thick soil cover was considered. Fifteen radargeologic rock units, various faults and fractures, as well as anticlinal and synclinal foldings were identified. Author

N74-19031# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

COMPARISON OF SOIL SURFACE TEMPERATURE MEASUREMENTS BY MEANS OF STANDARD SOIL MERCURY THERMOMETERS AND A BARNES PRT-5 INFRARED THERMOMETER

D. T. Anderson Nov. 1972 25 p refs

(INPE-268-RI/058) Avail: NTIS HC $4.25

A short account is given of the difficulties encountered in temperature measurement of boundary layers and a comparison

of two types of thermometers, an infrared radiometer and mercury in glass thermometer. Author

N74-19032# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOLOGY OF THE AREA 'SENHOR DO BONFIM' BASED ON SLAR MOSAIC INTERPRETATION
Liu Chan Chiang Jan. 1973 19 p
(Proj. SERE)
(INPE-278-RI/067) Avail: NTIS HC $4.00

From the criteria of tonal contrast, drainage pattern, all the landforms and the characteristic distribution and contact relationships of the rocks in the SLAR mosaic, the different rock units were distinguished. These include the basement complex, the plutonic unit, the metamorphic unit, the intrusive plutonic unit, the clastic sedimentary unit, the calcareous sedimentary unit 1 and 2, and the aluvison. From the topographic expressions and their microfeatures, distribution of the aerogeologic rock units, and the lineaments, many folds, faults and features are recognized from the SLAR mosaic. Tombador mountain range divides this area of study into two parts. The sedimentary terrain, which is in the west of Tombador mountain, yields the greatest amount of information from the radar imagery. The basement complex terrain, which is in the east of the mountain, yields the least information. In the Tombador mountain range there are several large intrusive granite bodies containing prominent dikes, and around the intrusive bodies there are features which suggest contact metamorphosed. Therefore this region of Tombador mountain is hopeful for valuable economic mineral researches. Author

N74-19033# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ON THE VALUES OF STRATOSPHERIC CIRCULATION INDEX OVER NATAL, BRAZIL
N. JaganMohanaRao, P. Satiamurty, and T. V. RamanaRao Jan. 1973 15 p refs
(INPE-291-RI/080) Avail: NTIS HC $4.00

The SCI values of zonal and meridional winds over Natal, Brazil are calculated. The results are compared with those of another southern hemispheric station ascension island, and circulation patterns in the stratosphere are discussed. Also a comparison is made of the zonal winds over Natal with those of an equatorial station (Thumba, India) and a station in the subtropics (Sonmiant, Arabian Sea island). Author

N74-19034# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PARTICLE PRECIPITATION IN BRAZILIAN GEOMAGNETIC ANOMALY DURING MAGNETIC STORMS
N. B. Trivedi, D. B. Rai, I. M. Martin, and Jose Marques DaCosta Jan. 1973 17 p refs
(INPE-296-RI/085) Avail: NTIS HC $4.00

Particle precipitation in Brazilian geomagnetic anomaly during magnetic storms is investigated using riometer and VLF propagation data. It is found that during large storms the changes in the ionosphere caused by particle precipitation are detectable. There is a good correlation between the behavior of the absorption and the variations of the magnetic field intensity during different phases of a storm. There seems to be a close relationship between the precipitation of high-energy particles and short-period fluctuations of the magnetic field intensity of the order of 5-6 minutes. During the main phase of the storm, when the field intensity reaches its minimum, the flux of soft electrons also plays a significant role in producing absorption. The nature of precipitation associated with a sudden commencement appears to be more complex; the predominance of low or high energy particle flux may depend on the magnitude of the field increase. Author

N74-19035*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DIGITAL IMAGE REGISTRATION METHOD BASED UPON BINARY BOUNDARY MAPS
R. R. Jayroe, J. F. Andrus, and C. W. Campbell Washington Mar. 1974 36 p refs
(NASA-TN-D-7607; M-121) Avail: NTIS HC $3.25 CSCL 08B

A relatively fast method is presented for matching or registering the digital data of imagery from the same ground scene acquired at different times, or from different multispectral images, sensors, or both. It is assumed that the digital images can be registed by using translations and rotations only, that the images are of the same scale, and that little or no distortion exists between images. It is further assumed that by working with several local areas of the image, the rotational effects in the local areas can be neglected. Thus, by treating the misalignments of local areas as translations, it is possible to determine rotational and translational misalignments for a larger portion of the image containing the local areas. This procedure of determining the misalignment and then registering the data according to the misalignment can be repeated until the desired degree of registration is achieved. The method to be presented is based upon the use of binary boundary maps produced from the raw digital imagery rather than the raw digital data. Author

N74-19036# Servicio Meteorologico Nacional, Buenos Aires (Argentina).
SEISMOLOGICAL ANNALS FOR THE CENTRAL OBSERVATORY OF BUENOS AIRES, 1966 TO 1970 [ANALES SISMOLOGICOS, OBSERVATORIO CENTRAL, BUENOS AIRES, 1966 - 1970]
1972 50 p In SPANISH
(Rept-29) Avail: NTIS HC $5.50

Seismological observations are tabulated for each month during this period. The time of occurrence, magnitude, and epicenter of each shock are shown. Transl. by F.O.S.

N74-19037# Servicio Meteorologico Nacional, Buenos Aires (Argentina).
SEISMOLOGICAL ANNALS FOR THE CENTRAL OBSERVATORY OF BUENOS AIRES, 1961 TO 1965 [ANALES SISMOLOGICOS, OBSERVATORIO CENTRAL BUENOS AIRES, 1961 - 1965]
1972 31 p In SPANISH
(Rept-28) Avail: NTIS HC $4.75

For abstract, see N74-19036.

N74-19038*# Texas A&M Univ., College Station. Remote Sensing Center.
REMOTE MEASUREMENT OF TURBIDITY AND CHLOROPHYLL THROUGH AERIAL PHOTOGRAPHY
Martin David Schwebel, Wesley P. James, and William J. Clark Dec. 1973 148 p refs
(Grant NGL-44-001-001)
(NASA-CR-137383; RSC-47) Avail: NTIS HC $10.50 CSCL 08H

Studies were conducted utilizing six different film and filter combinations to quantitatively detect chlorophyll and turbidity in six farm ponds. The low range of turbidity from 0-35 JTU correlated well with the density readings from the green band of normal color film and the high range above 35 JTU was found to correlate with density readings in the red band of color infrared film. The effect of many of the significant variables can be reduced by using standardized procedures in taking the photography. Attempts to detect chlorophyll were masked by the turbidity. The ponds which were highly turbid also had high chlorophyll concentrations; whereas, the ponds with low turbidity also had low chlorophyll concentrations. This prevented a direct correlation for this parameter. Several suggested approaches are cited for possible future investigations. Author

N74-19039# Joint Publications Research Service, Arlington, Va.
HYDROACOUSTICAL MEASUREMENTS IN OCEANOLOGY
E. S. Taranov et al 15 Mar. 1974 80 p refs Transl. into ENGLISH from the book "Gidroakusticheskiye Izmereniya v Okeanologii" Leningrad, 1972 p 211-243, 280-322
(JPRS-61489) Avail: NTIS HC $7.00

A discussion is given of spectral analysis of noise and interference in hydroacoustics, measurement of sound velocity and of losses in ground, and statistical acoustic measurements. Author

N74-19040*# Colorado State Univ., Fort Collins.
MODERN CONTROL CONCEPTS IN HYDROLOGY

Nguyen Duong, Gearold R. Johnson, and C. Byron Winn Feb. 1974 108 p refs
(Contract NAS8-28655)
(NASA-CR-129020) Avail: NTIS HC $8.50 CSCL 08H

Two approaches to an identification problem in hydrology are presented based upon concepts from modern control and estimation theory. The first approach treats the identification of unknown parameters in a hydrologic system subject to noisy inputs as an adaptive linear stochastic control problem; the second approach alters the model equation to account for the random part in the inputs, and then uses a nonlinear estimation scheme to estimate the unknown parameters. Both approaches use state-space concepts. The identification schemes are sequential and adaptive and can handle either time invariant or time dependent parameters. They are used to identify parameters in the Prasad model of rainfall-runoff. The results obtained are encouraging and conform with results from two previous studies; the first using numerical integration of the model equation along with a trial-and-error procedure, and the second, by using a quasi-linearization technique. The proposed approaches offer a systematic way of analyzing the rainfall-runoff process when the input data are imbedded in noise. Author

N74-19041*# Wisconsin Univ., Madison. Inst. for Environmental Studies.
REMOTE SENSING IN THE MIXING ZONE
J. R. Villemonte, J. A. Hoopes, D. S. Wu, and T. M. Lillesand Aug. 1973 34 p refs Presented at AWRA Intern. Symp. on Remote Sensing of Water Resources, Burlington, Ontario, 11-14 Jun. 1973 Submitted for publication Sponsored in part by Dept. of Natural Resources
(Grant NGL-50-002-127)
(NASA-CR-137304; Rept-22) Avail: NTIS HC $4.75 CSCL 08H

Characteristics of dispersion and diffusion as the mechanisms by which pollutants are transported in natural river courses were studied with the view of providing additional data for the establishment of water quality guidelines and effluent outfall design protocols. Work has been divided into four basic categories which are directed at the basic goal of developing relationships which will permit the estimation of the nature and extent of the mixing zone as a function of those variables which characterize the outfall structure, the effluent, and the river, as well as climatological conditions. The four basic categories of effort are: (1) the development of mathematical models; (2) laboratory studies of physical models; (3) field surveys involving ground and aerial sensing; and (4) correlation between aerial photographic imagery and mixing zone characteristics. Author

N74-19042*# Wisconsin Univ., Madison. Inst. for Environmental Studies.
THE REMOTE SENSING OF AQUATIC MACROPHYTES PART 1: COLOR-INFRARED AERIAL PHOTOGRAPHY AS A TOOL FOR IDENTIFICATION AND MAPPING OF LITTORAL VEGETATION. PART 2: AERIAL PHOTOGRAPHY AS A QUANTITATIVE TOOL FOR THE INVESTIGATION OF AQUATIC ECOSYSTEMS
T. D. Gustafson and M. S. Adams Sep. 1973 28 p refs Sponsored in part by AEC
(Grant NGL-50-002-127; Grant NSF AG-199)
(NASA-CR-137305; Rept-24) Avail: NTIS HC $4.50 CSCL 08A

Research was initiated to use aerial photography as an investigative tool in studies that are part of an intensive aquatic ecosystem research effort at Lake Wingra, Madison, Wisconsin. It is anticipated that photographic techniques would supply information about the growth and distribution of littoral macrophytes with efficiency and accuracy greater than conventional methods. Author

N74-19043*# Techtran Corp., Glen Burnie, Md.
STUDY OF STATISTICAL CHARACTERISTICS OF SEA WAVE SLOPES ACCORDING TO CHARTS OF WAVE STEREOPHOTOGRAPHY
L. M. Martsinkevich Washington NASA Mar. 1974 8 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 11, 1970 p 83-86
(Contract NASw-2485)
(NASA-TT-F-14758) Avail: NTIS HC $4.00 CSCL 08C

The statistical characteristics of the slopes of waves are calculated on the basis of charts of wave stereophotography. It is shown that the distribution of the projections of slope onto the main axis of wave propagation and onto the axis perpendicular to it obey a normal distribution law. The distribution of slopes corresponds to the theoretical law of distribution, derived previously. Author

N74-19044*# Techtran Corp., Glen Burnie, Md.
STUDIES OF THE ENVIRONMENT FROM SPACE
K. Ya. Kondratyev Washington NASA Mar. 1974 9 p Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 7, 1971 p 108-111
(Contract NASw-2485)
(NASA-TT-F-14759) Avail: NTIS HC $3.00 CSCL 08F

This review of studies conducted in the United States on the problem of investigating the environment from space, is based on materials of the 21st International Congress on Astronautics, held in West Germany in October 1970. Author

N74-19045# Sandia Labs., Albuquerque, N.Mex. Optics Div.
EFFECTS OF ATMOSPHERIC TURBULENCE ON OPTICAL RESOLUTION AT TONOPAH TEST RANGE
K. Hessel Oct. 1973 61 p refs
(Contract AT(29-1)-789)
(SLA-73-514) Avail: NTIS HC $5.25

The possibility of monitoring optical resolution conditions at Tonapah Test range was studied with emphasis on atmospheric turbulence. Basic turbulence concepts, and methods for analyzing the propagation of electromagnetic waves through the atmosphere are discussed along with methods for determining the refraction constant. Modulation transfer functions of optical systems are also discussed. F.O.S.

N74-19046# Brookhaven National Lab., Upton, N.Y.
ATMOSPHERIC DIFFUSION FROM AN OFF-SHORE SITE
P. Michael, G. S. Raynor, and R. M. Brown 1973 10 p refs Presented at Symp. on the Phys. Behavior of Radioactive Containment in the Atmosphere, Vienna, 12 Nov. 1973 Sponsored by AEC
(BNL-18301; IAEA/SM-181/5; Conf-731110-5) Avail: NTIS HC $3.00

Analysis of the fate of airborne effluents from a nuclear reactor at an off-shore site requires a better understanding of overwater atmospheric dispersion than currently exists. For this reason, a diffusion study was undertaken off the south shore of Long Island, New York, about 100 km from New York City. This study used tracer material (oil fog smoke) released from an anchored boat. Measurements of mean wind, turbulence, and temperature were made on portable towers on the beach, from an aircraft, and aboard the source boat. Plume geometry was documented by photography and from quantitative concentration measurements. Experiments under a variety of meteorological conditions indicate that over-water dispersion is very sensitive to meteorological conditions. From measured diffusion parameters it was observed that over-water dispersion is sigificantly less than over land, particularly when the onshore flow is due to the sea breeze. Author (NSA)

N74-19047# Sandia Labs., Albuquerque, N.Mex.
FRACTURE OF COAL AND OIL SHALE FOR IN SITU PROCESSING OR REMOTE REMOVAL: A PROPOSAL SUPPORT DOCUMENT
L. D. Tyler and W. D. Weart Oct. 1973 17 p refs
(Contract AT(29-1)-789)
(SLA-73-946) Avail: NTIS HC $3.00

The proposal sets forth the concept of using the synergistic effects of a combination of hydraulic and explosive techniques to fracture these formations in a controlled manner.
Author (NSA)

N74-19048# California Univ., Livermore. Lawrence Livermore Lab.
GEOGRAPHICAL DISTRIBUTION OF APPROXIMATELY 100-keV ELECTRONS ABOVE THE EARTH'S ATMOSPHERE
F. D. Seward 3 Oct. 1973 11 p refs

(Contract W-7405-eng-48)
(UCRL-51456) Avail: NTIS HC $4.00

Previously unpublished satellite data is used to show the distribution of approximately 100-keV electrons above the earth's atmosphere. Specific regions of high counting rate are mapped at altitudes of 300 to 400 km. These regions are used to predict the suitability of various launch sites for rocket-borne X-ray astronomical experiments. Author (NSA)

N74-19049# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jul. 1973 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE 1973]
Jul. 1973 31 p In FRENCH and DUTCH
Avail: NTIS HC $4.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes, Belgium, are tabulated for July 1973. ESRO

N74-19050# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Aug. 1973 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE]
Aug. 1973 31 p In FRENCH and DUTCH
Avail: NTIS HC $4.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes, belgium, are tabulated for Aug. 1973. ESRO

N74-19051# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Jul. 1973 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, JUILLET 1973]
Jul. 1973 26 p In FRENCH and DUTCH
Avail: NTIS HC $4.50

Geophysical data obtained at Dourbes, Belgium, relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during July; 1973 are presented. ESRO

N74-19052# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Aug. 1973 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, AOUT 1973]
Aug. 1973 26 p In FRENCH and DUTCH
Avail: NTIS HC $4.50

Geophysical data obtained at Dourbes, Belgium, relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during August 1973 are presented. ESRO

N74-19053# Stockholm Univ. (Sweden). Inst. of Meteorology.
GAS-PHASE NITROGEN AND METHANE CHEMISTRY IN THE ATMOSPHERE
Paul Crutzen 29 Jun. 1972 24 p refs Presented at the Summer Advanced Study Inst., Phys. and Chem. of Upper Atmospheres, Orleans-La Source, France, 31 Jul. - 11 Aug. 1972 Submitted for publication
(AP-10) Avail: NTIS HC $4.25

In order to justify the possible role of large scale supersonic transport operation, the gas phase chemistry of the troposphere was investigated. Reactions included the production and destruction of ozone, sources and sinks for the NOx, the odd H reactions, and the oxidation of methane. Distributions of trace gases in the stratosphere were tabulated. It is concluded that many problems of both chemical and meteorological nature must be solved before any reliable predictions can be made regarding ozone reduction due to the effects of large scale supersonic transport operation. ESRO

N74-19054# Bundesanstalt fuer Bodenforschung, Hannover (West Germany).
RESULTS OF THE REFLECTION SEISMIC SURVEY MANGANESE NODULES I MADE FROM THE SS VALDIVIA IN THE EQUATORIAL PACIFIC [ERGEBNISSE REFLEXIONSSEISMISCHER MESSUNGEN DER VALDIVIAFAHRT 'MANGANKNOLLEN 1 IM AEQUATORIALEN PAZIFIK]
Karl Hinz and Hans-Ulrich Schlueter Bonn Bundesmin. fuer Forsch. und Technol. Nov. 1973 21 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FBM-73-01) Avail: NTIS HC $4.25; ZLDI, Munich 4 DM

Zones of differing reflection characteristics are the predominant events on the seismic records taken in the equatorial Pacific. At present it is assumed that the economically interesting nodules become concentrated mainly in areas of siliceous ooze. For this reason an attempt was made to correlate the zones of different reflection characteristic (seismic fazies) with pelagic sediments. The observed seismic fazies types and the results of the correlation are discussed. Author (ESRO)

N74-19055# Metallgesellschaft, A.G., Frankfurt am Main (West Germany). Abteilung Mineralogie.
BLACK SAND PLACERS I PROJECT OFF MOZAMBIQUE. OREMICROSCOPIC INVESTIGATIONS ON MAGNETIC SEPARATION PRODUCTS [SCHWERMINERALSEIFEN 1 VOR MOCAMBIQUE. ERZMIKROSKOPISCHE UNTERSUCHUNGEN AN MAGNETISCHEN AUFBEREITUNGSPRODUKTEN]
Hugo Westenberger Bonn Bundesmin. fuer Forsch. und Technol. Nov. 1973 57 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FBM-73-02) Avail: NTIS HC $6.00; ZLDI, Munich 11.55 DM

Numerous products of magnetic separations of heavy mineral sands were investigated by means of ore microscopy, chemical analyses, and electron microprobe analyses. In addition to the identification of the mineral association the chromium contents were investigated as a significant feature. The results can be summarized as follows: all ferromagnetic products are composed mainly of titaniferrous-magnetite with high tenors of chromium. The ilmenite concentrates contain 44.7 to 46.7% TiO2 and 0.09 to 0.11% Cr2O3. Chromium is present in the form of chromite and chromspinelle grains and as an isomorphous constituent of hematite exsolution lamellae. Furthermore, higher chromium contents are found within exsolutions of rutile. Ilmenite without exsolutions of hematite contains practically no chromium. Author (ESRO)

N74-19056# Preussische Bergwerks- und Huetten A.G., Hannover (West Germany).
RESULTS OF LABORATORY ANALYSES OF SAMPLES TAKEN DURING THE PLACER I EXPLORATION ONBOARD THE RV 'VALDIVIA' OFF MOZAMBIQUE FROM 6 AUGUST TO 4 DECEMBER 1971 [LABORUNTERSUCHUNGEN AN EINER PROBENSERIE AUS DEM MIT DEM FS 'VALDIVIA' VOM 6. AUG. BIS 4. DEZ. 1971 DURCHGEFUEHRTEN 'SEIFEN 1'-EXPLORATIONS-VORHABEN VOR MOCAMBIQUE]
Kurt Meyer Bonn Bundesmin. fuer Forsch. und Technol. Nov. 1973 40 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FBM-73-03) Avail: NTIS HC $5.00; ZLDI, Munich 8 DM

Heavy mineral bearing sand samples from an area off Mozambique obtained during the exploration cruise Placer 1 with R. V. Valdivia from August to December 1971 were examined physically, mineralogically, and chemically. These investigations should give information about the regional distribution and content of heavy minerals and their chemical analysis, and the TiO2-and Cr-contents in ilmenite. Ilmenite is the most frequent valuable mineral with an average weight percentage of 4% in raw sand followed by zircone with approximately 0.4% and rutile/leukoxen with approximately 0.2% on the average. Author (ESRO)

N74-19057# Prakla-Seismos G.m.b.H., Hannover (West Germany).
MANGANESE NODULE EXPLORATION SYSTEM [MANGANKNOLLEN - EXPLORATIONSSYSTEM]
G. Braun, H. Ristow, and H. Weichart Bonn Bundesmin. fuer Forsch. und Technol. Nov. 1973 34 p refs In GERMAN;

ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FBM-73-05) Avail: NTIS HC $4.75; ZLDI, Munich 6,75 DM

Different tools for manganese nodule exploration are thoroughly investigated. Certain tools are selected applying technical and economical criteria. Three optimized exploration systems are designed as exa...ples. Author (ESRO)

N74-19058# Arbeitsgruppe fuer Physikalische Weltraumforschung, Freiburg (West Germany).
THE IMPEDANCE PROBE OF THE WORKING GROUP FOR SPACE PHYSICS RESEARCH [DIE IMPEDANZSONDE DER ARBEITSGRUPPE FUER PHYSIKALISCHE WELTRAUMFORSCHUNG (APW)]
Rainer Kist and Eugen Neske Bonn Bundesmin. fuer Forsch. und Technol. Nov. 1973 70 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. (BMFT-FBM-73-21) Avail: NTIS HC $6.50; ZLDI, Munich 14,30 DM

The development and evaluation of a radio frequency self impedance probe for determining ionospheric electron density is reported. The theory of the plasma impedance of a cylindrical sensor is discussed. Several probe models, including the Aeros satellite probe, are surveyed, and results of plasma chamber measurements are reported. Results from rocket sounding tests are presented. It is shown that the measured amplitude and/or phase information of the ionospheric electron density can be determined with the parallel resonance frequency. The absolute accuracy of this measurement is better than 10% and the relative accuracy is approximately 2% in an altitude range in which shocks can be disregarded (above 100 km). ESRO

N74-19059# General Electric Co., West Lynn, Mass.
SINGLE FLIGHT STEREO RADAR USING A MECHANICALLY SLEWED ARRAY AND AN ELECTRICALLY SQUINTED ARRAY
Gordon E. Carlson and George L. Bair Nov. 1973 158 p refs
(Contract N00014-69-A-0141-0008; NR Proj. 387-069)
(AD-771434; CSR-73-5) Avail: NTIS CSCL 08/2

An improved single flight technique for obtaining stereo radar image pairs is described and its feasibility is analyzed. This improved technique uses a unique combination of two different antenna beam characteristics which permits the illumination of a terrain point from nearly the same aircraft position while providing image geometry differences sufficient to provide useful parallax data. The analysis encompasses theoretical performance analyses, tradeoff analyses and, error analyses. The error analyses are also used to select a best set of reconstruction equations for computation of the terrain point orthographic position and height from image position measurements made with a stereocomparator. Comparisons are made of the theoretical and error performance for the improved single flight technique with respect to a previously implemented two-flight technique and a previously proposed single flight technique. (Modified author abstract) GRA

N74-19060# Illinois Univ., Urbana. Dept. of Electrical Engineering.
MEASUREMENTS AND APPLICATIONS OF IONOSPHERIC TOTAL ELECTRON CONTENT Final Report, 15 Sep. 1970 1970 - 14 Sep. 1973
Kung C. Yeh, Bernard J. Flaherty, Maurice Y. Youakim, and Scott F. Wetenkamp Oct. 1973 118 p refs
(Contract F19628-71-C-0013; AF Proj. 4643)
(AD-772711; UILU-ENG-73-2558; AFCRL-TR-73-0658; TR-52) Avail: NTIS CSCL 04/1

The report describes investigations on ATS-F receiver design and applications of electron content to propagation problems. The planned ATS-F satellite will transmit radio signals at several frequencies with associated modulations. These transmissions will enable experimenters to perform several measurements. These are Faraday rotation, dispersive Doppler and dispersive group delay. Based on design considerations a portion of the phase-lock receiver has been built and tested. The receiver seems to meet all requirements on both Faraday rotation and dispersive group delay measurements. Two propagation problems have been investigated. The first is concerned with the relation between the maximum usable frequency and electron content. The second is concerned with the effects of horizontal gradients on elevation angle and azimuthal angle of arrival of a radio signal. Author (GRA)

N74-19061# Atlantic Science Corp., Indialantic, Fla.
DOCUMENTATION AND DESCRIPTION OF THE BENT IONOSPHERIC MODEL Final Report
Sigrid K. Llewellyn and Rodney B. Bent Jul. 1973 209 p
(Contract F04701-73-C-0207; AF Proj. 8666)
(AD-772733; AFCRL-TR-73-0657; SAMSO-TR-73-252) Avail: NTIS CSCL 04/1

The report documents the computer programs of the Bent Ionospheric Model and briefly describes the development of the model. The FORTRAN Program is designed for general use and can generate ionospheric data on a world-wide basis for any past or future date. For a given condition consisting of station, satellite and time information, the electron density versus height profile is computed from which range, range rate, and angular refraction corrections as well as vertical and angular total electron content are obtained. The model has the additional capability of improving its predictions by updating with actual ionospheric observations. Considerable tests in the past have proved this empirical model highly successful. Also included in the documentation is an alternate version of the ionospheric program to be used when stringent space and time requirements are imposed by the operating system. However, several options of the standard program are not incorporated and the accuracy of the results is somewhat reduced. Author (GRA)

N74-19062# Radiation Research Associates, Inc., Fort Worth, Tex.
MONTE CARLO STUDIES OF SKY RADIATION Final Report, 29 Jan. - 31 Jul. 1973
Wolfram G. Blaettner and Michael B. Wells 31 Aug. 1973 85 p refs
(Contract F19628-73-C-0130; AF Proj. 7621)
(AD-772640; RRA-T7311; AFCRL-TR-73-0613) Avail: NTIS CSCL 04/1

The report describes the work involved in making modifications to the FLASH and BRITE Monte Carlo procedures and using these programs to evaluate (1) the effects of neglecting polarization on the scattered light intensities in molecular and turbid atmospheres; (2) the error involved in using plane-parallel atmospheres to represent spherical atmospheres for large zenith angles of incidence; and (3) the effect of dust layers at different altitudes on the color ratios computed for twilight conditions. (Modified author abstract) GRA

N74-19063# California Inst. of Tech., Pasadena.
STEREOSCOPY OF CONTINUOUS DISTRIBUTION Final Technical Report, 1 Mar. 1971 - 30 Sep. 1973
Nicholas George Nov. 1973 46 p refs
(Contract F30602-72-C-0021; ARPA Order 1057)
(AD-772641; RADC-TR-73-354) Avail: NTIS CSCL 04/1

Stereoscopy is applicable to the problem of precisely determining the spatial structure of a photographic record. Using photogrammetric methods, numerical data was obtained for a selected stereo pair of photographs of a barium release cloud produced in the 1971 Secede II test series. The resolution limits of these methods are discussed, based on the inherent limitations of the photographic system. Unresolved problems remaining due to the nature of the photographic image - the cloud itself - are mentioned and a possible path toward their solution is outlined. Author (GRA)

N74-19064# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A THREE-DIMENSIONAL IONOSPHERIC MODEL USING OBSERVED IONOSPHERIC PARAMETERS
Charles M. Rush and David Miller Sep. 1973 54 p refs
(AF Proj. 5631)
(AD-772672; AFCRL-TR-73-0567; AFCRL-ERP-455) Avail: NTIS CSCL 04/1

An electron density model, which permits a three-dimensional specification of the ionospheric structure, has been developed. The model generates realistic electron density profiles in the altitude range from 100 to 800 km by making use of selected

ionospheric parameters that are routinely observed. The model also allows for the calculation of the electron distribution over the entire path of propagation of a radio signal by employing a synoptic mapping technique. The mapping technique enables ionospheric parameters observed at specific locations to be extended and extrapolated to regions where data are not normally accessible. The electron densities that are computed are done in a manner that is totally consistent with the observed parameters needed to generate the profiles. Author (GRA)

N74-19065# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

ON SIGNAL DECREASE IN HF CIRCUITS DURING PCA EVENTS

Ming S. Wong 2 May 1973 25 p refs

(AF Proj. 8666)

(AD-772656; AFCRL-TR-73-0289; AFCRL-ERP-444) Avail: NTIS CSCL 04/1

The principal morphological features of ionospheric absorption of cosmic radio noise at vertical incidence -due to influx into the polar ionosphere of solar protons with particle energy near 10 MeV, and as measured by ground-based riometers operated usually at 30 MHz- are reviewed with figures and brief descriptions. HF signal-intensity observations in two oblique-incidence circuits, Thule to College and Pt. Barrow to Kenai (Alaska), are compared with riometer measurements for several PCA events. It is suggested that a stand-by propagation mode, involving a combination of scattering and ducting of HF radio waves near the ionospheric-bottom-boundary, comes into play. It is also suggested that, during disturbed inospheric conditions, diminutions in ionospheric electron density -in addition to, or in conjunction with, increased ionospheric absorption- is an important contributing cause to HF radio blackouts. (Modified author abstract)

GRA

N74-19066# Army Electronics Command, Fort Monmouth, N.J.

A MEASUREMENT OF THE ABSORPTION COEFFICIENT OF ATMOSPHERIC DUST

James D. Lindberg and Larry S. Laude Dec. 1973 18 p refs

(DA Proj. 1T0-61102-B-53A)

(AD-772701; ECOM-5525) Avail: NTIS CSCL 04/1

A method developed by previous workers for measuring the absorption coefficient of strongly absorbing powdered materials has been applied to samples of atmospheric dust in the 0.3 to 1.1 micrometers wavelength interval. This work, which is based on the Kubelke-Munk theory of diffuse reflectance, provides an estimate of the optical absorption coefficient. The corresponding imaginary refractive index is calculated from this value. Results are given for several samples of dry atmospheric dust collected in the desert of southern New Mexico. (Modified author abstract)

GRA

N74-19067# New York Univ., N.Y. Inst. of Mathematical Sciences.

GEOSTROPHIC VORTICES ON A SPHERE

A. S. Peters Oct. 1973 23 p refs

(Grant DA-ARO(D)-31-124-73-G150; ARPA Order 2069)

(AD-772510; IMM-399) Avail: NTIS CSCL 04/1

The report contains an account of geostrophic vortices on a rotating sphere. A vortex of this type is characterized by a singular spherical harmonic of degree Nu and order zero. This function has a role analogous to that of the Bessel function which characterizes a rectilinear geostrophic vortex in a rotating plane.

Author (GRA)

N74-19068# Hydronautics, Inc., Laurel, Md.

CORRELATION OF MICRO- AND MACROSCOPIC STRUCTURES OF WIND WAVES AND DIFFERENTIAL ROUGHENING AND SMOOTHING OF SURFACE WAVES BY WIND

Jin Wu Nov. 1973 43 p refs

(Contract N00014-72-C-0509; ARPA Order 1910; NR Proj. 062-472)

(AD-772634; TR-7211-6) Avail: NTIS CSCL 04/2

Simultaneous measurements were conducted in a wind-wave tank of the ripple slopes with an optical instrument and of the carrier-wave profiles with a wave-height gage. The experiments were conducted under various wind conditions: either steady or unsteady wind blowing over pre-existing regular surface waves. The data were analyzed to determine the slope distributions of ripples located on various portions of the carrier-wave profiles under steady wind, and the differential roughening and smoothing of the carrier waves under unsteady wind. The influences of pre-existing waves on the structure of the wind boundary layer, and on the slope statistics of ripples were also studied.

Author (GRA)

N74-19069# Army Electronics Command, Fort Monmouth, N.J.

ESTIMATES OF THE EXTINCTION OF ELECTROMAGNETIC ENERGY IN THE 8 TO 12 MICROMETER RANGE BY NATURAL ATMOSPHERIC PARTICULATE MATTER

W. J. Lentz and G. B. Hoidale Jan. 1974 31 p refs

(DA Proj. 1T0-61102-B-53A)

(AD-772960; ECOM-5528) Avail: NTIS CSCL 04/1

Extinction coefficients, based on atmospheric dust sampled over southern New Mexico, are tabulated at 0.2 micrometer intervals from 8.0 to 12.0 micrometers for mass concentrations of 1000, 100, and 10 microgram/cubic meter. At a concentration of 1000 microgram/cubic meter, the peak extinction of about 0.1/km occurs at 9.6 micrometers. The method employed uses Mie theory to extrapolate the measured extinction of a suspension of dust in potassium bromide to the extinction of the dust suspended in air. Over the Middle East and North Africa it is estimated that concentrations of 1000 microgram/cubic meter and greater occur on an average of 50 to 150 days per year.

Author (GRA)

N74-19070# Delaware Univ., Newark.

RESEARCH IN THE COASTAL AND OCEANIC ENVIRONMENT Annual Status Report, 1 Sep. 1972 - 31 Aug. 1973

William S. Gaither and Vytautas Klemas Nov. 1973 35 p refs

(Contract N00014-69-A-0407; NR Proj. 388-096)

(AD-772104; TR-25) Avail: NTIS CSCL 08/3

Progress during the fourth year of a multi-disciplinary study of a section of the Atlantic seacoast (Delaware and adjacent areas of New Jersey and Maryland) is summarized. Models of coastal processes have been developed to aid in the analysis of coastal environments and for use in making precise short-term prediction of coastal change by means of intensive analysis of the near past historic records and sequence of geologic events. Continued theoretical investigations of wave action, model studies of sedimentary processes, and the results of additional observations of vegetative growth and of surface energy exchanges are reported. Two-dimensional optical spectral analysis of shallow water waves is discussed and other remote sensing results are summarized, with emphasis on frontal systems, suspended sediment and flow patterns in and outside Delaware Bay.

Author (GRA)

N74-19071# Naval Postgraduate School, Monterey, Calif.

SMALL SCALE TEMPERATURE FLUCTUATIONS NEAR THE SEA SURFACE M.S. Thesis

Michael Alan Nye Whittemore Mar. 1973 63 p refs

(AD-769424) Avail: NTIS CSCL 08/10

Thermistor measurements of small scale temporal and spatial fluctuations of temperature were made near the surface of the sea from the NUC Oceanographic Research Tower. Wave height, water particle velocity, sound velocity, and salinity were measured simultaneously. Data were subjected to statistical and spectral analyses. Temperature fluctuations were found to vary with wave height. A linear relation was found to exist between temperature fluctuations and wave swell. The assumed relationship was verified by the results of spectral analysis. (Modified author abstract)

GRA

N74-19072# Aerospace Corp., El Segundo, Calif.

OBSERVATIONS OF PRECIPITATING PROTONS WITH RING-CURRENT ENERGIES Technical Report, Jun. 1972 - Jun. 1973

Paul F. Mizera 23 Dec. 1973 36 p refs

(Contract F04701-73-C-0074)

(AD-772713; TR-0074(4260-20)-7; SAMSO-TR-73-400) Avail: NTIS CSCL 04/1

Precipitating protons with energies characteristic of the

storm-time ring current were measured during all phases of magnetic activity near the low-altitude trapping boundary at midnight. The objective of this study was to examine the energy dependence of the precipitating fluxes as a function of latitude (or L shell) and relative to the plasmapause and the low-energy isotropic electron enhancements which are associated with the outer-zone boundary. The low-energy measurements, taken by the OV1-17 satellite, covered the timer period from 19 March - 3 April 1969. Data, provided by the OV1-19 spacecraft during the same time period, were used to extend the measurements to higher energies and to examine pitch-angle distributions. (Modified author abstract) GRA

N74-19073# Analysis and Computer Systems, Inc., Burlington, Mass.
DATA ANALYSIS AND PROCESSING SYSTEMS FOR ROCKET BORNE EXPERIMENTS Final Report, 1 Apr. 1970 - 31 Mar. 1973
James R. Delaney and Arthur J. Markey Apr. 1973 99 p refs
(Contract F19628-70-C-0236)
(AD-772653; AFCRL-TR-73-0449) Avail: NTIS CSCL 04/1

The report discusses the general analysis and processing of digitized data from experiments flown on rockets in the 50KM to 300KM altitude range. Data formats, reduction techniques and mathematical formulas for specific experiments are detailed. Computer program routines developed for use in many applications are discussed. Author (GRA)

N74-19074# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
THE KINETIC ENERGY BALANCE OF THE FLORIDA STRAITS IN A VERTICAL SECTION BETWEEN MIAMI AND BIMINI M.S. Thesis
Zachariah R. Hallock Nov. 1973 68 p refs
(Contract N00014-67-A-0201-0013; NR Proj. 083-060)
(AD-772636) Avail: NTIS CSCL 08/3

Using profiling current meter (PCM) data obtained by Duing (1973) in the Florida Straits during project Synops 71, part of the expression for the kinetic energy exchange rate was evaluated. The principal results were that the significant kinetic energy exchange takes place in the upper 250 meters, and that it constitutes a restructuring of mean flow kinetic energy rather than a net local exchange with the fluctuations. GRA

N74-19075# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
EARTH'S PARTICLES AND FIELDS, 1973 Final Report, May - Dec. 1973
Billy M. McCormac and John E. Evans Dec. 1973 52 p refs
(Contract N00014-73-C-0376)
(AD-773132; LMSC-D356744) Avail: NTIS CSCL 04/1

The Summer Advanced Study Institute, Earth's Particles, and Fields, was held at The University, Sheffield, England, during the period August 13 to 24, 1973. There were 139 participants from 16 countries. Over 40 lectures were presented with approximately one-half of the time devoted to discussion. Lectures and discussions about theoretical and experimental research results concerning the structure and characteristics of the magnetosphere, magnetospheric models, convection and electric fields, substorms, and the Jovian magnetosphere are summarized. GRA

N74-19076# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
INVESTIGATION OF ATMOSPHERIC ION-NEUTRAL PROCESSES Final Report
E. E. Ferguson, A. L. Schmeltekopf, F. C. Fehsenfeld, and D. L. Albritton Jul. 1973 8 p refs
(AD-773097; DNA-3211F) Avail: NTIS CSCL 04/1

The application of the flowing afterglow technique, developed in National Oceanographic and Atmospheric Administration (NOAA) with Defense Nuclear Agency (DNA) support, to the measurement of atmospheric ion-neutral reactions has continued to be the major effort of the group. A number of significant results, essential to the understanding of the normal and disturbed ionospheres, have been obtained. The technique has been extended in the temperature range over which it operates and a new combined flowing afterglow-drift tube combination has been put in operation which closes the energy gap between thermal measurements and beam measurements. GRA

N74-19077# Oak Ridge National Lab., Tenn. School of Electrical Engineering.
A CENTER FOR THE DESCRIPTION OF ENVIRONMENTAL CONDITIONS: WEATHER PHENOMENA Final Report
W. L. Hughes, Paul A. McCollum, Edward L. Shreve, and Emmett J. Pybus Sep. 1973 342 p refs
(Contract DAAB07-68-C-0083; DA Proj. 1T0-61102-B-81A)
(AD-773046; OSU-WP-73-F-14; ECOM-0083-14) Avail: NTIS CSCL 04/1

A summary of results is made in this Final Report. Five major categories of information about severe storm sferics and severe storm characterizations are presented: (1) Statistical Descriptions of Lightning as a VLF Source; (2) Model Studies of Cloud and Sferic Behavior; (3) Hardward Developments; (4) Software Developments; and (5) Results of a Cumulus Cloud Magnetic Field Survey. It is concluded that VLF sferics has no intrinsic predictive content. However, sferic behavior is closely correlated with cloud development and vigor and thus has very high indicative content. A method for examining the electric current motions within a cumulus cloud by sensing the resulting magnetic field is shown to be feasible. Author (GRA)

N74-19078# Informatics, Inc., Rockville, Md.
SOVIET STUDIES OF GEOMAGNETIC PULSATIONS, NUMBER 2, DECEMBER 1973
Stuart G. Hibben Dec. 1973 121 p refs
(Contract F44620-72-C-0053; ARPA Order 1622)
(AD-773176; AFOSR-74-0073TR) Avail: NTIS CSCL 04/1

This is a collection of abstracts on geomagnetic pulsations as reported in the Soviet-bloc literature from approximately 1969 to the present. Emphasis is on Pc1 phenomena, but any article relating to hydromagnetic wave propagation has been included. The material supplements Soviet Studies on Pc1 Geomagnetic Pulsations, published in July, 1973. It is given in approximate chonological order, and an author index is appended. This report also serves as the optional topic for the October 1973 monthly report on Selected Material from Soviet Technical Literature. Author (GRA)

N74-19480* Scientific Translation Service, Santa Barbara, Calif.
CLASSIFICATION, SCALE SERIES AND NOMENCLATURE OF LUNAR CHARTS
K. P. Florenskiy, A. A. Gurshteyn, V. I. Korablev, L. M. Bugayevskiy, and K. B. Shingarev *In its* Current Concepts Regarding the Moon (NASA-TT-F-766) Feb. 1974 p 139-154 Transl. into ENGLISH of the book "Sovremennyye Predstavleniya o Lune" Moscow, Nauka Press, 1972 p 88-96 (For availability see N74-19475 10-30)
CSCL 08B

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N74-19079 Cincinnati Univ., Ohio.
QUANTITATIVE SCHLIEREN MEASUREMENTS BY THE PHOTOMULTIPLIER TECHNIQUE Ph.D. Thesis
Barry Wellesley Hannah 1973 233 p
Avail: Univ. Microfilms Order No. 74-98

A method for obtaining quantitative density information by using photomultiplier scanning of on line schlieren images has been developed. A second generation quantitatives schlieren system has been built for use with a supersonic tunnel developed and calibrated in conjunction with the project. The necessary numerical programs needed for data reduction have also been developed. The method has been applied to the following test

cases. The inviscid compressible flow field on a supersonic 10 deg half angle cone has been scanned and the data compared to the Taylor Maccoll analysis for this case. The method was proven valid for axisymmetric and two-dimensional inviscid flows and was then applied to the viscous flow fields. Dissert. Abstr.

N74-19080 Virginia Univ., Charlottesville.
AN OSCILLATING LINEAR SCANNER OF STELLAR IMAGES: A FEASIBILITY STUDY Ph.D. Thesis
Ronald Everett Zissell 1973 88 p
Avail: Univ. Microfilms Order No. 73-31176

An area scanner was designed, built, and tested on the 81-cm telescope. An electrically driven oscillating mirror performs the scanning at frequencies from 1.5 to 8.8 Hz. Synchronized alternating slits allow position-angle measurements to be made with just one setting of scan direction. The final image scale is 7.3-arc sec/mm. After each part of the system is described in detail, the mathematical form of the image profile is investigated. Ten binary systems with separations of 14.4 to 3.0-arc sec were observed and are illustrated. The mean separation error for single observations of three binaries was + or - 0.05-arc sec. Limitations of accuracy from atmospheric seeing and methods to overcome them are discussed along with coherent image integration techniques. Separation calibration for binaries is carried out by recording the image of a Ronchi Ruling within the scanner immediately after observing the binary. The method of calibrating the ruling from observations of a binary of known separation is given in detail. Dissert. Abstr.

N74-19081 Iowa State Univ. of Science and Technology, Ames.
EVALUATION OF VELOCITY PROFILES, STENOSES AND TURBULENCE USING CONTINUOUS-WAVE DOPPLER ULTRASOUND Ph.D. Thesis
Renito Li Tanhehco 1973 182 p
Avail: Univ. Microfilms Order No. 74-579

The use of the coefficient of variation of the intervals between the extreme values and zero crossings of a CW Doppler ultrasonic signal as an index in evaluating the frequency components of the signal and indirectly the velocity profiles of the flow which provided the Doppler signal is discussed. Numerical analyses on infinite flat plates and cylindrical models of flow were undertaken. The coefficient technique was applied also in the comparative evaluation of the relative curvature of the velocity profiles of blood flow in the carotid arteries of dogs. The present technique for the transcutaneous detection of stenoses and turbulence also makes use of the Doppler frequency shifts but depend largely on the qualitative evaluation of the sound patterns. The quantitative techniques investigated in this report enhances the sensitivity and standardization of diagnoses. Dissert. Abstr.

N74-19082+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
NOTE ON SOLAR PHOTOGRAPHY IN INTEGRATED LIGHT
Manoel Marteleto Aug. 1972 27 p refs
(Proj. RADA-SOL)
(INPE-227-RI/027) Avail: NTIS HC $4.50

Photography is a technique of particular importance in solar research, since it permits one to fix a solar event in time or to study its birth and evolution at different times and at different heights from the photosphere of the sun. To get high-quality photographs of the photospheric granulation, the sun is first regarded as a radiating object. The resolving power improvements and the adequacy of the effective focal length of the telescope to the emulsion requirements are, then, studied with a view to bringing out details such as a granule 1 in. of arc in diameter. All discussions suggest the use of an optical bandpass filter displaced towards the shorter wavelengths of the visible spectrum. This displacement is shown to be possible down to about 5,500 A, where Rayleigh scattering becomes a limiting factor. Besides good instrumental performance, the bad seeing conditions are introduced as a decisive disturbance to be avoided. Author

N74-19083*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CAPABILITIES OF ELECTRODYNAMIC SHAKERS WHEN USED FOR MECHANICAL SHOCK TESTING
W. Brian Keegan Jul. 1973 27 p refs
(NASA-TM-X-70425; X-321-73-204) Avail: NTIS HC $4.50 CSCL 14B

The results of a research task to investigate the capabilities of electrodynamic vibrators (shakers) to perform mechanical shock tests are presented. The simulation method employed was that of developing a transient whose shock response spectrum matched the desired shock response spectrum. Areas investigated included the maximum amplitude capabilities of the shaker systems, the ability to control the shape of the resultant shock response spectrum, the response levels induced at frequencies outside the controlled bandwidth, and the nonlinearities in structural response induced by a change in test level. Author

N74-19084*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS AND PERFORMANCE OF SEVERAL MASS SPECTROMETER RESIDUAL GAS ANALYZERS
William W. Hultzman Washington Mar. 1974 44 p refs
(NASA-TN-D-7554; E-7432) Avail: NTIS HC $3.25 CSCL 14B

The operation and properties of various mass-spectrometer residual gas analyzers for use in vacuum measurements were analyzed in terms of efficiencies of ion extraction, ion separation and transmission, and ion collection. Types of instruments studied were magnetic sector, omegatron, quadrupole, and monopole. Experimental results presented include absolute sensitivity to argon, relative sensitivity to 10 gases, and cracking patterns for these gases. It is shown that the properties are strongly dependent on instrument range, resolution, and the particular voltages, currents, or field intensities used to control the instrument. Author

N74-19085+ Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
A METHOD FOR REPRODUCING PICTURES TRANSMITTED BY METEOROLOGICAL SATELLITES
Roberto Vincente Calheiros Jul. 1972 17 p refs
(INPE-219-RI/020) Avail: NTIS HC $4.00

A simple method is described in which direct sampling of the APT subcarrier modulated by the video signal, displayed on the Y axis of a CRT is used to reproduce meteorological satellite pictures without need for AM detection. Screen light emission characteristics and picture formation on a common 35 mm negative film, both nonlinear effects, are combined to provide good overall linearity. A mathematical model is presented which describes the synchronous detection. The frequency response of the system is presented, showing that it acts as a low pass filter, reproducing the base band video and rejecting the higher order harmonics. Author

N74-19086*# Linguistic Systems, Inc., Cambridge, Mass.
ONE METHOD OF RESTORATION OF THE VALUE OF A CALIBRATION SIGNAL
N. N. Krupenio, V. A. Ladygin, and N. Ya. Shapirovskaya Washington NASA Mar. 1974 12 p Transl. into ENGLISH of "Ob Odnom Metode Vosstanovleniya Znacheniya Kalibrovochnogo Signala" Pr-137 Acad. Sci. USSR, Inst. of Space Res., Moscow, 1973 13 p
(Contract NASw-2482)
(NASA-TT-F-15290; PR-137) Avail: NTIS HC $4.00 CSCL 14B

A method for restoration is reported for the level of a calibration signal in an instrument whose value is beyond the measurement limits of the recording system. The restoration process employs recordings of transitional processes involved in switching the instrument from the measurement mode to the calibration modes. An experimental check showed that the accuracy of restoration of the calibration levels was close to the measurement accuracy of the recording system. Author

N74-19087# National Bureau of Standards, Washington, D.C. Measurement Engineering Div.
ENGINEERING AND CONSTRUCTIONAL MANUAL FOR AN INSTRUMENT TO MAKE BURN HAZARD MEASUREMENTS IN CONSUMER PRODUCTS
Louis A. Marzetta Feb. 1974 48 p refs Sponsored by Consumer Product Safety Comm.

(NBS-TN-816) Avail: SOD HC $0.85 as C13.46:816

Surface temperature measurement alone is insufficient to establish the hazard of human contact with a hot or cold object. A metal surface is more likely to cause thermal injury than a plastic surface at the same temperature. An instrument equipped with a measuring probe has been developed for indicating the tissue temperature that would be experienced if human contact were made with the hot surface in question. The correct value of interface contact temperature can be read for a selected contact time without knowing the composition or temperature of the heated material under test. A detailed set of instructions and drawings for assisting in the construction of the device is included in the manual. Several test procedures are described for use in checking the performance of the measuring probe and instrument. Author

N74-19088*# Minnesota Univ., Minneapolis. Dept. of Physics.

COSMIC RAY TELESCOPE FOR OGO 2 AND 4 SPACECRAFT Final Report, 1 Jul. 1962 - Jul. 1969

William R. Webber 26 Mar. 1974 4 p

(Contract NAS5-3096)

(NASA-CR-137238) Avail: NTIS HC $4.00 CSCL 20F

The construction and subsequent flight are described of a cosmic ray telescope aboard the OGO-2 and 4 Spacecraft. This instrument was a combination Cerekov-scintillation counter telescope designed to measure the cosmic ray energy spectrum from 1-15 GV and charge composition from Z=1-8. OGO-2 was launched in October 1965; however, attitude control problems caused a rapid loss of control gas, so that after approximately 2 weeks it was no longer possible to point the spacecraft. This mission was officially declared a failure. The cosmic ray instrument appeared to work well during this time. OGO-4 was launched in July 1967, with a similar telescope aboard. It operated successfully approximately one year. The details of the experiment, its operation, and the results are given. Author

N74-19089*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GSFC MAGNETIC FIELD EXPERIMENT EXPLORER 43

J. B. Seek, J. L. Scheifele, and N. F. Ness Jan. 1974 52 p refs Submitted for publication

(NASA-TM-X-70609; X-692-74-29) Avail: NTIS HC $5.75 CSCL 14B

The magnetic field experiment flown on Explorer 43 is described. The detecting instrument is a triaxial fluxgate magnetometer which is mounted on a boom with a flipping mechanism for reorienting the sensor in flight. An on-board data processor takes successive magnetometer samples and transmits differences to the telemetry system. By examining these differences in conjunction with an untruncated sample transmitted periodically, the original data may be uniquely reconstructed on the ground. Author

N74-19090# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).

A LASER ENERGY MONITOR WITH DIGITAL OUTPUT

B. R. Clemesha May 1972 13 p

(INPE-203-RI/004) Avail: NTIS HC $4.00

An instrument for monitoring the energy output of a pulsed laser, and displaying this quantity in digital form is described. The device operates by measuring the charge which flows in a photo-diode exposed to a small fraction of the laser output. A pulse is generated whose duration is accurately proportional to the charge flow, and the duration of the pulse is subsequently measured by digital timer techniques. The linearity of the instrument is better than 0.5%. Author

N74-19091# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A COMPARISON BETWEEN A CONTACT AND A NONCONTACT METHOD FOR MEASURING THE LEAF SURFACE TEMPERATURE

Mostafa K. Nosseir Jan. 1973 46 p refs

(INPE-284-RI/073) Avail: NTIS HC $5.50

The upper leaves surface temperature of Citrus and Mango were measured by a contact method and a non-contact method. The contact method was by using the thermocouples, and the non-contact method was by Precision Radiation Thermometer. Air temperature, relative humidity, incoming radiation and sunshine duration were the meteorological parameters which were measured during the experiment. The difference between leaf temperature and air temperature was the final result and the parameter was correlated between the meteorological parameters and the physiological response of the plants. Author

N74-19092# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A DATA ACQUISITION UNIT FOR AIRGLOW MEASUREMENTS

B. R. Clemesha Feb. 1973 23 p

(INPE-315-RI/098) Avail: NTIS HC $4.25

The data acquisition unit consists of a five digit decimal counter with appropriate gate generating circuits to enable the photon pulse rate from a photomultiplier to be measured. A wide range of gate intervals and sample rates are available. A crystal master oscillator controls the gate interval and sample rate, and also provides the time reference for a five digit decimal clock. The counter contents and the time information are available at a rear panel connector for connection either directly to a Hewlett Packard type 5050B printer, or through the data interface to a tape punch. The input to the counter is via an amplifier and discriminator circuit giving a threshold voltage of 200 mV. Author

N74-19093*# National Aeronautics and Space Administration. Pasadena Office, Calif.

SERVO-CONTROLLED INTRAVITAL MICROSCOPE SYSTEM Patent Application

Momtaz M. Mansour (JPL), Harold J. Wayland (JPL), and Carl P. Chapman, inventors (to NASA) (JPL) Filed 4 Sep. 1973 29 p

(Contract NAS7-100)

(NASA-Case-NPO-13214-1; NASA-Case-NPO-13215-1; US-Patent-Appl-SN-394149) Avail: NTIS HC $4.50 CSCL 14B

A microscope viewing system is provided which can maintain an in-focus enlarged view of a moving living body area. The system includes a beam splitter assembly behind the objective lens for directing light onto a viewing device and onto the targets of two video cameras, one target is located slightly in front of the image plane while the other target is located behind the image plane. A separate focus sensing circuit connected to each video camera includes a band pass filter for passing only the frequency components in an optimum high frequency band of the video signal, a differentiator, a detector, and a lowpass filter for generating a dc signal whose magnitude represents the degree of focus of the corresponding camera. The low pass filters of the two circuits are connected to a difference amplifier which generates a signal that drives a servo that moves the objective lens towards and away from the object. NASA

N74-19094# Joint Publications Research Service, Arlington, Va.

AUTOMATIC GAS DETECTORS

N. G. Farzane and L. V. Ilyasov 18 Mar. 1974 138 p refs Transl. into ENGLISH of the book "Avtomaticheskiye Detektory Gazov" Moscow, Energ., 1972 168 p

(JPRS-61505) Avail: NTIS HC $10.00

Automatic gas detection systems which are used extensively in the design of automatic gas analyzers are discussed. Detailed descriptions are given of automatic gas detectors sensitive to density, viscosity, heat of combustion, and dielectric constant. Detectors based on various effects of ionization of gases and on optical and acoustic phenomena are described. Calibration of automatic detection systems is discussed. Author

N74-19095*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FLIGHT TEST OF A PRESSURIZATION SYSTEM USED TO MEASURE MINOR ATMOSPHERIC CONSTITUENTS FROM AN AIRCRAFT

Gregory M. Reck, Daniel Briehl, and Porter J. Perkins Washington Mar. 1974 26 p refs

(NASA-TN-D-7576; E-7701) Avail: NTIS HC $3.25 CSCL 14B

A flight evaluation of an ambient air sample pressurization system was conducted at altitudes between 6 and 12 km. The system regulated the sample pressure to 10.1 5 + or - 0.1 N/sq n and provided sample flow to three gas analysis instruments included in the system. Ozone concentrations measured by two instruments employing different techniques varied from about 30 parts per billion by volume (ppbv) to over 350 ppbv, and the two ozone monitors agreed to within 20 ppbv. A carbon dioxide analyzer indicated modifications required for future installations. Author

N74-19096# Brookhaven National Lab., Upton, N.Y. Health Physics and Safety Div.
[DEVELOPMENT OF RADIATION MEASUREMENT AND ALARM SYSTEMS AND RELATED EQUIPMENT] Annual Progress Report, 1 Jan. - 31 Dec. 1972
1 Aug. 1973 37 p Sponsored by AEC
(BNL-18102) Avail: NTIS HC $4.00

Research data are reported on alarm and safety equipment for radiation environments. Research topics outlined include: a radiation monitoring and alarm system (Amcos 2) for habitable areas of an accelerator complex, a digital environmental monitor, direct measurements of dose equivalent in aircraft, sampling and analysis of radioactive substances in the atmosphere, reactor effluents: as low as practicable or as low as reasonable, and a portable mixed radiation dose equivalent meter. Topics are also included on minimizing surface dose with medium electron shields, environmental monitoring of TLD studies, charcoal filter efficiency, semiautomatic film reader, radiation calibration facility, TLD extremity dosimeter, radiological assistance plan, secondary calibrator using Sr-Y beta's, automation of gamma spectroscopy nanometer dosimetry using liquid scintillators, personnel dosimetry at the AGS, expected energetic secondary neutrons missing in 200 MeV proton water shield, and Halon 1301 fire tests. NSA

N74-19097# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDIES, DEVELOPMENT, AND TESTING OF A DEVICE FOR DYNAMICALLY MEASURING SPECIFIC HEATS BETWEEN 4 AND 300 K Ph.D. Thesis - Grenoble Univ., 17 Dec. 1971
Robert Lagnier Jul. 1973 72 p refs In FRENCH
(CEA-R-4419) Avail: AEC Depository Libraries HC $5.75

An apparatus for measuring the specific heat of various materials between 4 and 300 K is described. These measurements are carried out with linear rise in temperature thereby ensuring very rapid operations and measurements. The first part of the study is devoted to a detailed description of the apparatus, and of the method of differential calorimetry by power compensation used for this type of measurement. A critical study of the apparatus in operation, on the basis of a series of tests, if given. Also, a statement of the results of measurements of specific heat on miscellaneous samples is given, thereby establishing the range of possibilities offered by the use of the apparatus (copper, alumina, niobium, niobium-titanium, and erbium orthochromite). Author (NSA)

N74-19098# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
CONTRIBUTION TO THE STUDY OF THERMOCOUPLE DRIFTS. PHYSICAL ELECTRONICS OF THE THERMOELECTRICAL EFFECT AND OUTLINE OF AN ELEMENTARY THEORY OF THE HETEROGENEOUS THERMOCOUPLE
F. Mathieu and R. Meier Aug. 1973 133 p refs In FRENCH Sponsored by EURATOM
(EUR-4874-F) Avail: AEC Depository Libraries HC $8.75; EUR FB 165,

With the aid of a model based on physical electronics it is shown that the measurable emf delivered by a thermocouple is entirely generated in the thermal gradient without any contribution coming from the hot junction. This holds also for drifts initially present or appearing with time. Starting from this fact, a simple experimental method is proposed that allows the problem of thermocouple drift estimation to be studied quantitatively. The heterogeneous wires are thermoelectrically explored by means of a laboratory furnace with a flat temperature profile, the temperature being increased successively to different values. The measured emfs called error emfs are error signals corresponding to specified experimental conditions. They allow the evaluation of the real drifts that a heterogeneous thermocouple will display when put into service in a given situation complying with some general criteria. Author (NSA)

N74-19099# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
AUTOMATIC STRAIN INDICATOR
D. A. Esparza 1973 6 p In SPANISH; ENGLISH summary
(CNEA-347) Avail: AEC Depository Libraries HC $3.00

The mechanism that shows the whole deformation during experiments concerning plastic deformation, at a constant tension, or at the constant strain rate is described. All phases of the experiment can be related to a differential indicator of deformation; instantaneous velocity can be duduced. Author (NSA)

N74-19100*# Sandia Corp., Albuquerque, N.Mex.
DESIGN AND CONSTRUCTION OF A LOW-VELOCITY BOUNDARY-LAYER TEMPERATURE PROBE
B. F. Blackwell and R. J. Moffat (Stanford Univ., Calif.) 1973 14 p refs Presented at the AIAA/ASME Thermophys. and Heat Transfer Meeting, Boston, 15 Jul. 1973 Sponsored in part by AEC
(Grant NGL-05-020-134)
(NASA-CR-137258; SLA-73-5604; Conf-730728-1) Avail: NTIS HC $4.00 CSCL 14B

A small thermocouple temperature probe was designed and fabricated for use in low velocity turbulent boundary layer studies. The primary probe design objective was the elimination of temperature errors due to conduction along the thermoelectric elements. It is shown that not only probe geometry but also the thermal characteristics of the two thermoelectric elements influence conduction errors. Design curves for four common thermoelectric pairs are presented. An experimental turbulent boundary-layer temperature profile is presented and compared with the theoretical laminar sublayer equation to verify that the designed probe was free of conduction errors. Author (NSA)

N74-19101# Osservatorio Astronomico, Rome (Italy). Gruppo di Spettroscopia Solare.
REFORMULATION OF INFORMATION ON GRID SPECTROSCOPY [LA RICOSTRUZIONE DELLE INFORMAZIONI NELLA SPETTROSCOPIA A RETICOLO]
G. A. DeBiase, F. Sacchetti, and D. Trevese Oct. 1972 12 p refs In ITALIAN Presented at the 58th Congr. Nazl. della Soc. Ital. di Fis.
(Contract CNR-70.01104.02)
(RR-2) Avail: NTIS HC $4.00

The problems relating to the reconstruction of the real spectral distribution obtained by reticulated spectrograph are considered. The transfer function of an ideal reticle was analyzed numerically. The role of noise in this process is discussed and an optimal filter determined for a transfer function obtained from many reticle synthesis. Experimental results obtained using an ideal reticle are compared to those of the synthesis of two ideal reticles with half the latter's length. The suitability of the synthesis of reticles is discussed as well as limitations of this method regarding signal to noise ratio. ESRO

N74-19102# Osservatorio Astronomico, Rome (Italy). Gruppo di Spettroscopia Solare.
MEASUREMENT OF PHOTOSPHERIC MICROTURBULENCE USING PHOTOGRAPHIC ISODENSITOMETRY [MISURA DELLE MICROTURBOLENZE FOTOSFERICHE MEDIANTE EQUIDENSITOMETRIA FOTOGRAFICA]
Vincenzo Croce Jan. 1973 5 p refs In ITALIAN
(RR-5) Avail: NTIS HC $4.00

A photographic isodensitometric method for the study of Doppler fluctuations of neutral Fe spectral line, photographed in quiet photosphere, is presented. The results confirm the well-known relation between ascending motions and photospheric nucleus luminosity. ESRO

N74-19103# Kiruna Geophysical Observatory (Sweden).
VLF RECEIVER CALIBRATION
Svante Westerlund Sep. 1973 25 p
(KGO-73-3) Avail: NTIS HC $4.25

One loop is used for creating a known field at the position

of another loop. Theoretical principles, including axial magnetic field from a magnetic dipole in the form of a loop and the equivalent circuit diagram of a loop, are outlined. The calibration setup and some computer programs to simplify calibration are presented. The results of calibration are shown and instructions for conversion of paper chart readings to field strength are illustrated with an example. ESRO

N74-19104# Howaldtswerke-Deutsche Werft, Kiel (West Germany). Abteilung Elektronik.
FURTHER DEVELOPMENT OF BATHYSONDE: OCEANOGRAPHIC RESEARCH SYSTEM FOR CONTINUOUS MEASURING OF TEMPERATURE, PRESSURE, CONDUCTIVITY, AND SOUND VELOCITY [FORTENTWICKLUNG DER BATHYSONDE; MESSEINRICHTUNG FUER DIE MEERESFORSCHUNG ZUR KONTINUIERLICHEN MESSUNG DER TEMPERATUR, DES DRUCKES, DER LEITFAEHIGKEIT UND DER SCHALLGESCHWINDIGKEIT]
Claus Kankeleit, Arnfried Preuss, Heinz Pedersen, and Bodo Holtfoht Bonn Bundesmin. fuer Forsch. und Technol. Nov. 1973 16 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FBM-73-06) Avail: NTIS HC $4.00; ZLDI, Munich 2,95 DM

A measuring system for oceanographic research for continuous measuring of temperature (range -2 to +40 deg), pressure (0 to 6000 dbar), conductivity (0 to 008/ohms cm) and sound velocity (1400 to 1650 m/s) to a depth of 6000 m has been developed. Digital indication of the measured results, analog output, and parallel and serial digital outputs are possible. ESRO

N74-19105# Purdue Research Foundation, Lafayette, Ind.
STUDY OF THE CHARACTERISTICS OF THE HOLOGRAPHIC STEROMODEL FOR APPLICATION IN MENSURATION AND MAPPING, PART 1 Final Report
David L. Gifford and Edward M. Mikhail Jul. 1973 242 p refs
(Contract DAAK02-72-C-0063; DA Proj. 4A1-61102-B-52C)
(AD-772043; ETL-CR-73-14-Pt-1) Avail: NTIS CSCL 14/5

Photogrammetric analysis of preparation and recording of the holographic stereomodel shows that either independent relative orientation or a modified double rectification operation results in a stereomodel with component images which have equal principal distances. Analysis of distortions due to reconstruction reference beam geometry errors, for both holograms of directly recorded objects and holographic stereomodels, shows that the reconstruction beam geometry error budget is more limited than formerly believed. The mensuration investigation shows that a single dot system does not yield acceptable accuracy. Mathematical analysis and experimental data confirm this contention. A double dot mensuration system is proposed to attain suitable accuracy. An experiment to compare the measurement potential of a holographic stereomodel to other established techniques is described and analyzed. Statistical analysis of the results of that experiment indicates no differences in the accuracy attained between any of the methods considered. Author (GRA)

N74-19106# Newcastle-upon-Tyne Univ. (England). Dept. of Metallurgy.
DYNAMIC FRACTURE TOUGHNESS MEASUREMENT Final Technical Report, May 1972 - Apr. 1973
J. Congleton and B. K. Denton Jun. 1973 51 p refs
(Contract DAJA37-72-C-3926)
(AD-771146; ERO-E-1552) Avail: NTIS CSCL 14/2

K(Id) values for polymethyl methacrylate (PMMA) glass and Pitho tool steel have been measured by a technique based on crack velocity measurements. Fracture induced by combined tensile and impact loading can cause a crack to decelerate, pass through a minimum velocity then accelerate again. The crack tip stress intensity at the minimum crack velocity is the dynamic fracture toughness for that velocity. The values obtained for PMMA and glass show that the K(Id) for slow moving cracks are significantly smaller than both the corresponding K(Ic) and the K(Id) values for fast moving cracks. For the oil quenched tool steel K(Id) for fast moving cracks was about 25% greater than K(Ic) but only limited data for the steel is as yet available. Reasons for the variation of fracture toughness with crack velocity are discussed. Author (GRA)

N74-19107# Sperry Rand Corp., Phoenix, Ariz. Flight Systems Div.
ANGLE OF ATTACK COMPUTATION SYSTEM Final Report
Duane B. Freeman Sep. 1973 60 p ref
(Contract F33615-71-C-1280)
(AD-771183/1GA; Rept-71-0353-00-00; AFFDL-TR-73-89)
Avail: NTIS HC $3.50 CSCL 01/4

The results of a program to evaluate computing angle-of-attack by inference using air data, aircraft acceleration, surface positions and stored aerodynamic data are presented. The computation was implemented in an analog type airborne computer and evaluated in a U.S. Air Force RF-4C aircraft. The mathematical relationships selected for calculating the aircraft angle-of-attack, the system implementation and the flight test program are described herein. The flight test data is reduced, and computed angle-of-attack is compared to the output of an externally mounted vane. As indicated by the results, computed angle-of-attack is feasible and accurate with normally available onboard aircraft sensors. Author (GRA)

N74-19108# Panametrics, Inc., Waltham, Mass.
DESIGN AND FLIGHT EVALUATION OF CHARGED PARTICLE DETECTION SYSTEM FOR ROCKET EXPERIMENTS Final Report, 1 Mar. 1970 - 31 Aug. 1973
Frederick A. Hanser, Bach Sellers, and Jean L. Hunerwadel Aug. 1973 38 p refs
(Contract F19628-70-C-0219; AF Proj. 7601)
(AD-772735; AFCRL-TR-73-0612) Avail: NTIS CSCL 18/4

Five auroral particle detection systems for use on rockets have been constructed, and four of these flown and the data returned used to evaluate instrument performance. The systems consist of an electrostatic analyzer (ESA) for electrons of 1 to 20 (or 16) keV, an electron scintillator-photomultiplier combination for 20 (or 16) to 200 keV electrons, and either an ESA (for 1 to 20 or 16 keV) or a solid state detector (for 0.2 to 3.8 MeV) for protons. (Modified author abstract) GRA

N74-19109# North Carolina State Univ., Raleigh.
A PRELIMINARY EXPERIMENTAL INVESTIGATION OF THE MANGANIN STRESS TRANSDUCER Technical Report, 1 Sep. 1967 - 31 Aug. 1974
R. S. Steele and R. A. Douglas Dec. 1973 72 p refs
(Contract N00014-68-A-0187; NR Proj. 064-504)
(AD-772633; TR-73-4) Avail: NTIS CSCL 14/2

The report contains the preliminary development of a manganin foil stress gage for use in monitoring one dimensional stress waves occurring in axially impacted rods. The results of tests used to calibrate the manganin foil gage to uniform radial strain are presented. These data are used in conjunction with the response of the gage to simultaneously applied axial compression and Poisson straining to find an empirical expression relating the response of the manganin gage to one dimensional stress. Also discussed are limitations on the application of this particular stress transducer. Author (GRA)

N74-19110# Environmental Research Inst. of Michigan, Ann Arbor.
THERMOPLASTIC MODULATOR FOR SPECTRUM ANALYSIS BY COHERENT OPTICAL MEANS Final Report, 1 Jan. - 30 Jun. 1973
I. Cindrich, G. D. Currie, and C. Leonard Dec. 1973 44 p refs
(Contract F33615-73-C-1113)
(AD-773148; ERIM-100800-8-F; AFAL-TR-73-385) Avail: NTIS CSCL 20/6

Development of real-time thermoplastic modulator data storage techniques for spectrum analysis by coherent optical processing methods is described. A laboratory model unit developed in a preceding program was utilized with emphasis placed on investigating the wideband properties of the writing beam, the thermoplastic recording medium, and vacuum requirements. Experimental recording to 50 MHz was accomplished. A specially designed coaxial transmission line electron gun which provides very high bandwidth for writing beam current

modulation was investigated. New thermoplastic substrates offering a larger recording area were fabricated. An analysis was made of the vacuum environment and components needed for minimum vacuum pumping in the present experimental modulator and for eventual sealed-off operation of the recording chamber. Recorded data format geometry was investigated to determine its influence on the spatial distribution of the output data obtained after optical processing for spectrum analysis.
Author (GRA)

N74-19437* National Research Council of Canada, Ottawa (Ontario).
PHOTOGRAPHIC FIREBALL NETWORKS
Ian Halliday *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 1-8 refs (For availability see N74-19436 10-30)
CSCL 14E

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N74-19111 Wales Univ. Inst. of Science and Technology, Cardiff. Dynamic Analysis Group.
PRELIMINARY NOTE ON DATA PROCESSING SCHEMES FOR QUALITY ASSURANCE
J. H. Williams Apr. 1972 48 p refs
(DAG-50) Copyright. Avail: Issuing Activity
Two basic types of data processing schemes for quality assurance have been considered: statistical and visual aid. The visual aid scheme examined is the cumulative sum with and without data pre-smoothing. A preliminary comparison of the efficiency of various schemes in detecting drift has been made. The process used to compare the two approaches is an RC network which has been used for a fault diagnosis simulation study.
Author

N74-19112 British Steel Corp., London (England). Strip Mills Div.
A BIBLIOGRAPHY OF THE USE OF ELECTROMAGNETIC PUMPS FOR THE TRANSPORT OF LIQUID METALS
R. L. Davies [1973] 8 p refs
(SM/BIB/794) Copyright. Avail: Issuing Activity
Abstracts of 40 papers concerning the use of electromagnetic pumps for molten iron and other metals are presented. F.O.S.

N74-19113 Central Electricity Generating Board, London (England).
BEARINGS FOR POWER STATION PLANT. A SELECTIVE BIBLIOGRAPHY, 1960 - SEPTEMBER 1973
E. F. Hansford, comp. Feb. 1974 26 p refs
(CE-Bib-28B.1) Avail: Issuing Activity
Selected abstracts of 108 articles concerning research on bearings are presented. Areas reported include materials, lubrications, vibration, and failure.
F.O.S.

N74-19114 Cincinnati Univ., Ohio.
A MODEL TO PREDICT EROSION IN TURBOMACHINERY DUE TO SOLID PARTICLES IN PARTICULATED FLOW Ph.D. Thesis
George K. Grant 1973 227 p
Avail: Univ. Microfilms Order No. 74-97
A computerized model is developed to predict the erosion resulting from natural dust injection into turbomachinery. This model considers the aerodynamic drag on the dust particle, the rebound dynamics of the particles impacting the solid blades or channel walls and the material removal process. The equations of motion of a sand particle under the influence of aerodynamic drag are developed in an inertial coordinate system. The method of solution presented is very easy to use in that only one first order differential equation has to be solved. High speed movies were taken of the sand particles which were accelerated in a specially designed wind tunnel. These results demonstrate the extreme accuracy of this method of solution. The impact and rebound characteristics of the high speed particles are experimentally determined for different particle velocities and impact angles. The impact parameters are found to be statistical in nature and thus the statistical distributions are obtained. Dissert. Abstr.

N74-19115 University Coll., Cardiff (Wales). Dynamic Analysis Group.
FAULT DIAGNOSIS USING TIME DOMAIN MEASUREMENTS
H. Sriyananda and D. R. Towill Jul. 1972 32 p refs
(DAG-44) Copyright. Avail: Issuing Activity
A voting technique is used to diagnose fault conditions down to component level in a feedback control system using only the input-output cross-correlation function measured at suitable time delays. These time delays are chosen using a new formula based on Bayes' theorem, which ranks the time delays in order of usefulness in fault diagnosis; it can be readily applied at the design stage, thus assisting the integration of system design and test functions. A learning approach to the design of a fault diagnosis scheme is described which makes full use of any available failure data, together with the ranking formula for time delay selection, in the creation of an optimum scheme. Results obtained on a complex electro-hydraulic servo are presented which show that the scheme works satisfactorily in the presence of measurement noise and parameter drift, two factors which often cause a breakdown in conventional pattern recognition techniques.
Author

N74-19116*# United Aircraft Corp., East Hartford, Conn.
ELECTRON BEAM, LASER BEAM AND PLASMA ARC WELDING STUDIES
Conrad M. Banas Mar. 1974 30 p refs
(Contract NAS1-12565)
(NASA-CR-132386) Avail: NTIS HC $4.50
This program was undertaken as an initial step in establishing an evaluation framework which would permit a priori selection of advanced welding processes for specific applications. To this end, a direct comparison of laser beam, electron beam and arc welding of Ti-6Al-4V alloy was undertaken. Ti-6Al-4V was selected for use in view of its established welding characteristics and its importance in aerospace applications.
Author

N74-19117# Bureau of Mines, Morgantown, W.Va. Energy Research Center.
NONCAKING COAL GASIFIED IN A STIRRED-BED PRODUCER Technical Progress Report
R. V. Rahfuse, G. B. Goff, and A. J. Liberatore Mar. 1974 11 p refs
(BM-TPR-77) Avail: NTIS HC $4.00
Noncaking 0- by 2-inch subbituminous A coal from New Mexico was gasified with air and steam at 205 psig using a stirred-bed producer to determine coal losses by entrainment in the gas for this low sulfur, high ash coal which contained 20 percent particles smaller than 1/16-inch sieve size. The use of fine sized coal has particular importance because most production from mechanized mines is smaller than 2-inch size. This initial attempt showed technical feasibility for gasifying New Mexico subbituminous coal containing small sized particles in fixed-bed producers without excessive coal loss by entrainment. Dust loss averaged about 2 percent of moisture free coal, most of which was recovered from the gas. Ash clinkering was controlled by adding 1,010 lb/hr steam to reduce temperatures in the combustion zone. Yield of low-Btu fuel gas, 150 Btu per scf, dry, amounted to 69,800 scfh from 1,490 lb/hr coal (as received) and 3,450 lb/hr air (dry).
Author

N74-19118*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF FLUROINE CONTENT, ATMOSPHERE, AND BURNISHING TECHNIQUE ON THE LUBRICATING PROPERTIES OF GRAPHITE FLUORIDE
Robert L. Fusaro Washington Mar. 1974 25 p refs
(NASA-TN-D-7574; E-7492) Avail: NTIS HC $3.00 CSCL 11H
Eight different graphite fluoride compounds with fluorine to

carbon ratios varying from x = 0.25 to 1.1 were evaluated as burnished films in order to determine the effect of fluorine content on the solid lubricant properties of graphite fluoride. For comparison, similar experiments were conducted on graphite burnished films. It was found that even a small amount of fluorine in graphite fluoride (CF0.25)n improved the lubricating properties of graphite. However, such factors as burnishing atmosphere, burnishing technique, test atmosphere, and specimen temperature affected the results as much as varying the fluorine to carbon ratio of the compound. Best life was found for films that were machined burnished in moist air and tested in moist air. Author

N74-19119# Cambridge Univ. (England). Dept. of Engineering.
EXPERIMENTAL INVESTIGATION OF STAGGERED TANDEM VANE PUMP IMPELLERS
J. P. Gostelow and P. J. Watson 1972 23 p refs
(CUED/A-Turbo/TR-38) Avail: NTIS HC $4.25

Serveral slotted and staggered tandem vane water pump impellers were tested and their performance was compared. Simple slotting of the vanes did not produce improvements in the head flow rate characteristic. There was a marginal improvement in efficiency at low flow rates, but a reduction in efficiency at high flow rates. The staggered tandem vane configurations generally produced advantages in the head rise and efficiency characteristics and were observed causing a reduction in the extent of cavitation. The optimum configuration gave a 7% increase in flow rate over the basic impeller for the same head rise. The corresponding improvement in efficiency was 1%. Author

N74-19120# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PROCEEDINGS OF AEROSPACE TESTING SEMINAR
1 Jun. 1973 294 p Seminar held at Palo Alto, Calif., 31 May - 1 Jun. 1973
(LMSC-D381323) Avail: NTIS HC $17.75

A seminar was conducted to inform the Government-Industrial organizations of problems and solutions involved in testing aerospace systems. The subjects discussed include the following: (1) test planning, (2) system testing, (3) component testing, and (4) piece parts testing. Specific application of performance and environmental tests to solder joints, ball bearings, semiconductor devices, ceramics, and aerospace vehicle structures are presented. For individual titles, see N74-19121 through N74-19140.

N74-19121 Lockheed Missiles and Space Co., Sunnyvale, Calif.
SSD TEST BASELINE SUMMARY
E. E. Ingebretsen *In its* Proc. of Aerospace Testing Seminar 1 Jun. 1973 18 p (For availability see N74-19120 10-15)

The philosophy and development of a test baseline program are discussed. The objective of the program was to develop a standard to be used as a starting point for developing test plans in order to achieve consistency in test requirements for all programs. The baseline document provides for deviations from the basic test plan, when required, and establishes a data base for future revisions. The scope of the test baseline includes qualification and acceptance testing of parts, subassemblies, components, modules, and systems used in aerospace vehicles. The types of tests to be conducted and the test sequence for component acceptance are tabulated. Author

N74-19122 Lockheed Missiles and Space Co., Sunnyvale, Calif.
PARTS BASELINE
W. Geller *In its* Proc. of Aerospace Testing Seminar 1 Jun. 1973 14 p (For availability see N74-19120 10-15)

A baseline test program for reliability analysis and quality control of parts used in aerospace vehicles is described. The test requirements are established for: (1) vendor selection, (2) type standardization, (3) configuration analysis, (4) evaluation testing, (5) process control testing, (6) screening, and (7) destructive physical analysis. The technical features of the selection and testing program are tabulated. Author

N74-19123 Lockheed Missiles and Space Co., Sunnyvale, Calif.
ANALYSIS OF SYSTEM TEST FAILURES
P. F. Brown *In its* Proc. of Aerospace Testing Seminar 1 Jun. 1973 8 p (For availability see N74-19120 10-15)

Test procedures for reducing the number of functional failures that occur in spacecraft system acceptance testing are discussed. The failure categories for the acceptance tests are shown as workmanship, parts, design, and unknown. Typical percentages of the occurrence of each type of failure are presented. Specific types of failure for each category are analyzed. The system test failures by test type are tabulated to show the number of failures, the number of vehicles involved, and the failures per vehicle. Author

N74-19124* National Aeronautics and Space Administration, Washington, D.C.
ANALYSES OF FLIGHT MODEL SPACECRAFT PERFORMANCE DURING THERMAL-VACUUM TESTS
R. E. Heuser *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 15 p (For availability see N74-19120 10-15)

In 1968 a study of the thermal-vacuum test results from 11 flight model spacecraft was published in NASA Technical Note TN D-4908. A major interest then was the relationship of malfunctions to their times of occurrence in test. From that study conclusions were drawn with respect to the length of time required for an adequate thermal-vacuum test of flight model spacecraft. A serious limitation on the study was the small amount of documented data available. The purpose of the present report is to update and to extend the findings of that study. The test results of 39 spacecraft, compared with the test results of 11 spacecraft used in the earlier study, now provide a better basis for the analysis. The new data were developed for analysis in the same manner as for the 1968 report, in order to facilitate comparison of the two studies. However, the larger data base made additional types of analyses worthwhile, and the present results are a significant extension of the earlier work. Author

N74-19125 Lockheed Missiles and Space Co., Sunnyvale, Calif.
SYSTEM LEVEL PYRO-SHOCK TESTING
A. L. Ikola *In its* Proc. of Aerospace Testing Seminar 1 Jun. 1973 11 p (For availability see N74-19120 10-15)

The application of pyro-shock testing to aerospace vehicle systems is discussed. The pyro shock environment is generated by the detonation of explosive devices on the vehicle systems. The shock environment produced consists of a high g level and high frequency transient vibration. The subjects discussed are: (1) systems and component level quality testing, (2) considerations for development of margin criteria, and (3) method for developing system test margins. Graphs of typical shock spectra, peak g ratio, and overtest factors are presented. Author

N74-19126 Aerospace Corp., El Segundo, Calif.
DEVIATION OF SHOCK ENVIRONMENTAL CRITERIA
T. D. Schoessow *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 19 p (For availability see N74-19120 10-15)

The environment produced by pyrotechnic devices used for shock tests of aerospace vehicle components is defined. The shock test criteria are established. The application of the test procedure to a component of the Titan 3 launch vehicle is described. The characteristics and operation of the barrel tester and explosive joints for shock test performance are illustrated. Author

N74-19127 Lockheed Missiles and Space Co., Sunnyvale, Calif.
EFFECTS OF CONFIGURATION AND EXCITATION ON SYSTEM LEVEL ACOUSTIC TESTING c23
W. J. Henricks *In its* Proc. of Aerospace Testing Seminar 1 Jun. 1973 10 p (For availability see N74-19120 10-15)

An analysis of system level acoustic test procedures and methods for reducing the costs of such tests are discussed. The results of an acoustic test program to evaluate the effects of test configuration and mode of acoustic excitation are presented. The conditions investigated are the flight environment and ground test simulation. The acoustic test configuration and the test specimen configuration are illustrated. Author

N74-19128 Boeing Co., Seattle, Wash.
AEROSPACE TEST PLANNING AND CONDUCT DIS-

CIPLINES c34

S. Baber *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 11 p (For availability see N74-19120 10-15)

Engineering test disciplines are discussed that can minimize test errors and optimize program technical, schedule, and cost trades. The application of these disciplines is related to a system level spacecraft test. The minimum test preparation activities required to assure successful test conduct are identified. These test activities include the planning, documentation, hardware, checkout, and readiness review necessary for a flight spacecraft vibration acceptance test. Requirements for unique test control and protection systems, cleanliness, ambient environments, facility support services, safety, data acquisition, and quality control are considered. Author

N74-19129 Martin Marietta Corp., Baltimore, Md.

HIGHLIGHTS OF THE LONG-LIFE ASSURANCE STUDY

R. W. Burrows *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 22 p (For availability see N74-19120 10-15)

Procedures for conducting long-life assurance tests for achieving hardware with a service life of ten years are discussed. The subjects studied for long life assurance are: (1) integrated circuits, (2) derating, (3) electronic packaging, (4) tape recorders, (5) electric motors, (6) valves, and regulators, and (7) temperature cycling. Specific procedures to be followed in testing various components are outlined. Author

N74-19130 Lockheed Missiles and Space Co., Sunnyvale, Calif.

FLIGHT HISTORY SUMMARY

W. F. Wright *In its* Proc. of Aerospace Testing Seminar 1 Jun. 1973 2 p (For availability see N74-19120 10-15)

The flight history summary of twenty-nine aerospace vehicles is presented. The flight failure summary is tabulated according to catastrophic, degradation of mission, and non-critical conditions. The specific causes of the failures for each category are explained. Author

N74-19131 Martin Marietta Corp., Baltimore, Md.

REMARKS, CHALLENGES, AND TRENDS IN TESTING

R. W. Burrows *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 8 p (For availability see N74-19120 10-15)

Follow on testing of qualification test hardware in the form of weak link testing of aerospace vehicle components is discussed. It is stated that the development test program should be used to determine and eliminate all the marginalities practicable. The development test program should include selected exposures to the more significant environments at levels exceeding qualification levels, functional parametric testing using levels exceeding the specification values, and some degree of life testing when wear-out failure modes are present. The five types of margins to be considered are given as: (1) functional, (2) environmental, (3) life, (4) contamination susceptibility, and (5) transient susceptibility. Author

N74-19132 TRW, Inc., Redondo Beach, Calif.

TEMPERATURE CYCLING OF SOLDER JOINTS

J. R. Brown *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 11 p (For availability see N74-19120 10-15)

The procedures for conducting temperature cycling tests of solder joints to determine causes of failure are discussed. The four main areas contributing to the failure of a solder joint are described. The failure verification and fix testing results are analyzed. Guidelines for achieving reliable, stress-free solder connections to printed wiring boards are developed. Author

N74-19133 Hughes Aircraft Co., Culver City, Calif.

IMPROVED TESTING OF A COMPLEX DIGITAL CONTROL UNIT

M. DiMercurio *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 22 p (For availability see N74-19120 10-15)

Procedures for conducting quality control and reliability tests of electromechanical subsystems are discussed. A despin and attitude control subsystem unit is used as an example. The major features of the test plan are reported. Recommendations are submitted with respect to the following (1) power-on vibration tests, (2) thermal cycles with voltage margin, (3) thermal-vacuum cycles, (4) automated test equipment, and (5) special test points. Author

N74-19134 Lockheed Missiles and Space Co., Sunnyvale, Calif.

SIMULATION OF THE THERMAL-VACUUM ENVIRONMENT FOR INTERNALLY MOUNTED SPACECRAFT COMPONENTS

R. L. Wallace *In its* Proc. of Aerospace Testing Seminar 1 Jun. 1973 9 p (For availability see N74-19120 10-15)

Simulation of the thermal-vacuum environment during component-level qualification testing is described. The discussion is limited to internally mounted components since these can usually be treated as a set. The environment internal to the spacecraft is often sufficiently uniform that it can be described in a concise singular manner. External components would likely require a complex definition of the severe environment to which they are exposed including a description of the solar heat load and solar spectrum. Author

N74-19135 General Electric Co., New York.

EQUIPMENT SCREENS FOR HIGH RELIABILITY SPACE PROGRAMS

L. Sperling *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 25 p (For availability see N74-19120 10-15)

A program of test screens for a complex high reliability electronic space equipment is presented. The test program is based on the following elements: (1) wedge testing, (2) 500 hour minimum on-time active testing requirement, (3) failure/anomaly free resolution prior to shipment, (4) reliability analysis, and (5) malfunction fault isolation and analysis. A matrix of parts screening/control requirements for spaceborne equipment is tabulated. The failure category distribution is analyzed with respect to the test environment. Author

N74-19136 Boeing Co., Seattle, Wash.

COMPONENT ENVIRONMENTAL TEST INTEGRATION

H. M. McDaniel *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 10 p (For availability see N74-19120 10-15)

A typical component level environmental test program in the aerospace industry is described. Details are provided on documentation controls, surveys of subcontractor test agencies, certification of facilities, qualification and acceptance testing, and computer tabulation of specification compliance. Examples used in the presentation are from a spacecraft environmental test program which include primarily sine and random vibration, and space simulation. As an example of a typical test program, the Mariner Venus/Mercury 1973 was selected. The spacecraft mission includes a flyby of both Venus and Mercury and is scheduled for launch in early November, 1973. There is one flight spacecraft and one test spacecraft. Many of the components were hand fabricated, low production items requiring high reliability. Author

N74-19137 Hughes Aircraft Co., Culver City, Calif.

DEVELOPMENT, CONDUCT, AND SOME CONSEQUENCES OF PARTICLE IMPACT NOISE TESTING OF SEMICONDUCTORS

G. G. Ross *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 15 p (For availability see N74-19120 10-15)

A reliability test program for vibration and impact tests of semiconductor devices is described. The advantages and disadvantages of the system are discussed. A diagram of the test facility for conducting particle impact noise tests is provided. The validation process and the results of a typical test are reported. Author

N74-19138 Lockheed Missiles and Space Co., Sunnyvale, Calif.

ACOUSTIC TEST FOR DETECTION OF FLAWS IN BALL BEARINGS

R. W. Pfeil *In its* Proc. of Aerospace Testing Seminar 1 Jun. 1973 13 p (For availability see N74-19120 10-15)

Methods for electronically testing ball bearings are presented. The most common defects found in bearings are described. The tests are based on the vibration or acoustic phenomena generated by irregularities in the bearing surfaces. A mathematical model for calculating flaw impact frequency is developed. Of the methods

used for fault detection, the flaw impact rate method provides more information since the location of the flaw can be predicted. Author

N74-19139 Aerospace Corp., El Segundo, Calif.
ACCELERATED LIFE TESTING OF SEMICONDUCTOR DEVICES
R. O. Frantik *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 17 p (For availability see N74-19120 10-15)

Accelerated life tests of semiconductor devices are discussed. The quantitative effects of temperature on the life characteristics are examined. The techniques for accelerated temperature testing are identified as step stress and constant stress. Failure distributions accumulated for several different temperatures are needed to determine how service life changes with temperature. The Arrhenius plot is a convenient way of showing these changes. A straight line relationship will exist between the variables if the logarithm of life is plotted against the reciprocal of absolute temperature. The accelerated temperature testing technique provides a means of assessing, within reasonably short periods of time, the reliability for a given application of a given lot of semiconductor devices. Author

N74-19140 TRW, Inc., Redondo Beach, Calif.
SELECTION AND EVALUATION OF GENERAL PURPOSE CERAMIC CAPACITORS
In LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 8 p (For availability see N74-19120 10-15)

The characteristics of general purpose of ceramic dielectric capacitors are discussed. Methods for manufacturing the capacitors are described. Formal acceptance inspection of the finished capacitors consists of one hundred percent screening tests and continuous lot sampling for environmental and long term life testing. Evaluation techniques using radiographic examination and destructive physical analysis are reported. Author

N74-19141# Oak Ridge Gaseous Diffusion Plant, Tenn. Physical Measurements Dept.
EVALUATION OF THE USE OF EDDY CURRENTS TO MEASURE THE THICKNESS OF NICKEL PLATING ON CARBON STEEL
J. H. Smith 17 Oct. 1973 35 p refs
(Contract W-7405-eng-26)
(K-1845) Avail: NTIS HC $4.00

The capability of using eddy current techniques to measure the thickness of nickel plating on carbon steel is investigated. Factors examined are the influence of: different plating baths (Watts and Sulfamate), different substrates (A285 and A516 carbon steels), and the effects of using different types of eddy current instrumentation (phase sensitivity versus amplitude sensitivity). The results show that the thickness of nickel plating (for the conditions described) can be measured accurately using eddy current techniques, if proper procedures are followed. These procedures are described along with many other variables that are associated with tests of this type. Author (NSA)

N74-19142# Sandia Labs., Livermore, Calif.
ELECTRON BEAM WELDABILITY OF HIGH-NITROGEN AUSTENITIC STAINLESS STEEL
J. A. Brooks Oct. 1973 22 p refs
(Contract AT(29-1)-789)
(SLL-73-60) Avail: NTIS HC $3.25

A study of four high-nitrogen austenitic stainless steel alloys has shown those alloys to be difficult to electron beam weld. Their weldability is very sensitive to welding parameters, and is directly related to the nitrogen content. A possible mechanism to explain the observed erratic welding behavior is proposed. Author (NSA)

N74-19143# Monsanto Research Corp., Dayton, Ohio.
PLANAR HIGH ENERGY PERMANENT MAGNETS Semi-annual Report, 1 Mar. - 30 Sep. 1973
R. J. Janowiecki and M. C. Willson Dec. 1973 49 p refs
(Contract DAAB07-73-C-0112; DA Proj. 1T7-62705-A-348)
(AD-771956; ECOM-0112-1) Avail: NTIS CSCL 09/1

The purpose of this program is to demonstrate the feasibility of fabricating cobalt-rare earth permanent magnets by the arc plasma spraying process. Property goals for spray-fabricated magnets consist of a coercive force of 6000 oersteds and a maximum energy product of eight million gauss-oersteds. A series of samarium-cobalt alloys (nominal 34 to 39 wt. % Sm-Co) were converted into spray powder and formed into magnets by plasma spraying onto removable substrates. (Modified author abstract) GRA

N74-19144# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DEVICE FOR SPREADING SMALL GRAIN BAIT LURE
A. V. Barabash 30 Nov. 1973 6 p Transl. into ENGLISH from Zashch. Rast. (Moscow), no. 11, 1968 p 21
(AD-772053; FTD-HT-23-588-74) Avail: NTIS CSCL 06/6

Considering the advantages of a twin-boom spreader for small grain bait, the All-Union Institute of Agriculture and Special Application of Civil Aviation in 1965 developed a new device for an AN-2 Aircraft. It insures a discharge of 0.5 to 2.0 kg/ha, and has an attachment for the reliable cut-off of baitspreading when turning off the apparatus. The aerial spreading is accomplished through twin booms, 6-7 m long, with a 23 m spacing between their outlets, which corresponds to a swath 50 m wide. GRA

N74-19145# Army Material Command, Texarkana, Tex. Intern. Training Center.
INVESTIGATION OF A LASER OPERATED DEVICE FOR INSPECTING DIMENSIONS OF SMALL IN-LINE ITEMS M.S. Thesis
Donald D. G. Lemons May 1973 52 p refs
(AD-771104; USAMC-ITC-3-73-7) Avail: NTIS CSCL 13/8

Since recent advancements in production line technology have surpassed present inspection and control techniques, a need has developed for a highly reliable inspection system capable of performing 1000 inspections per minute or greater. This research report presents such a system. The system operates by emitting a laser beam across the path of items on a production line. As the items pass through the beam a shadow is cast on a photo-transistor array. This array, in conjunction with digital circuitry, detects and analyzes the shadow resulting in a pulsed output which signifies if the measured attribute of the product is within the specified tolerances. Author (GRA)

N74-19146# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
INTERACTION BETWEEN PERFLUOROALKYL POLYETHER LINEAR AND CYCLIC DERIVATIVE FLUIDS AND HIGH TEMPERATURE BEARING STEELS IN OXIDATION CORROSION ENVIRONMENT Technical Report, Mar. 1972 - Jan. 1973
George J. Morris Nov. 1973 35 p refs
(AF Proj. 7343)
(AD-772679; AFML-TR-73-175) Avail: NTIS CSCL 11/8

This report describes the interaction between perfluoroalkyl polyether linear and cyclic derivative fluids and a high temperature bearing steel, WD-65, among others, studied in a laboratory oxidation-corrosion environment. Temperature ranges of 500F to 700F were covered by this investigation. (Modified author abstract) GRA

N74-19147# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHANGE IN THE MICROGEOMETRY OF SLIDING-FRICTION UNITS DURING OPERATION IN NITRIC ACID
D. V. Galivets and D. I. Sorkin 30 Nov. 1973 13 p refs Transl. into ENGLISH from Khim. Mashinostr. (Moscow), no. 15, 1972 p 16-21
(AD-772651; FTD-HT-23-267-74) Avail: NTIS CSCL 13/9

The paper studies slide bearings made of nonmetallic materials with lubrication of 42% nitric acid. Studied were bearings made of antifriction graphite, fluoroplastic-4 and slag microcrystalline glass at specific pressures of 1.0-9.0 kg/sq. cm. and a journal circular speed of 1-8.3 m/s. Removable journals were made from acid-resistant chrome-nickel austenite-ferrite stainless steel EI-654. The microgeometry of the friction surfaces was determined on the VEI-Kalibr profilometer-profilograph and the MIM-7 microscope. GRA

N74-19483* Scientific Translation Service, Santa Barbara, Calif.
US STUDIES IN THE FIELD OF SHAFT DRILLING ON THE LUNAR SURFACE
B. V. Zakharyev and V. G. Kardysh *In its* Current Concepts Regarding the Moon (NASA-TT-F-766) Feb. 1974 p 192-205 refs Transl. into ENGLISH of the book "Sovremennyye Predstavleniya o Lune" Moscow, Nauka Press, 1972 p 117-124 (For availability see N74-19475 10-30)
CSCL 13I

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N74-19148 California Univ., Irvine.
STATISTICAL PROPERTIES OF LASER RADIATION SCATTERED FROM MOVING RANDOM ROUGH SURFACES: THEORETICAL AND EXPERIMENTAL ANALYSIS Ph.D. Thesis
Donald Gene Lubnau 1973 279 p
Avail: Univ. Microfilms Order No. 73-31428

The statistics of intensity fluctuations are also calculated. The scattering problem is approached using the Chu-Stratton integral equations for the field and the tangent plane assumption. By assuming the scattering surface can be described by Gaussian statistics, the general equations for the coherence matrix elements are derived. For the case where the variance of slope is moderate, these equations are further evaluated for the case of a reflected field and the field transmitted through a lossless dielectric (the pseudo-thermal source). The theory is also used to show how the statistics of a random surface may be measured by optical probing and how surface roughness affects the holography of moving scenes. Dissert. Abstr.

N74-19149 California Univ., Davis.
HIGH POWER DENSITY LASER EXCITATION MECHANISMS Ph.D. Thesis
Michael Arthur Samis 1973 185 p
Avail: Univ. Microfilms Order No. 73-32299

Two types of high power density carbon dioxide laser excitation systems are characterized. To this end, a mathematical model of the laser operation was developed and applied to the systems. The first system was a set of moderate pressure (40 torr) glow discharges operating a low efficiency (25%), high gain coefficient (2/m-torr of 12/m at 6 torr carbon dioxide) and intermediate power density (100 W/cu cm). The second system was a plasma jet excited laser of high efficiency (75%), high gain coefficient (20/m) and high power density (1000 W/cu cm). It was also simpler to operate than the previous system. The design of these systems depended on fluid mechanical considerations such as turbulence, stagnation points, supersonic expansions and shock waves. The design of the flow jet system was accomplished after a careful study of the relevant deactivation rates and allowable beam densities. Dissert. Abstr.

N74-19150 Utah Univ., Salt Lake City.
LASER RAMAN LIGHT SCATTERING STUDIES OF SOLIDS, LIQUIDS AND GASES Ph.D. Thesis
Randy Ben Wright 1973 319 p
Avail: Univ. Microfilms Order No. 74-184

Through the use of Raman light scattering spectroscopy the effects of temperature and/or pressure (density) variation on the inter- and intra-molecular interactions in various solids, liquids and gases has been investigated. Information derived from careful analysis of the frequency, intensity, and band shape as junctions of these intensive variables has enabled the molecular interaction processes to be qualitatively assessed. The microscopic order dependent processes in single crystal NH4Cl and NH4Br was studied over a wide range of temperature on both sides of the order-disorder phase transition which occurs in these crystalline solids. The study presents measurements and interpretations of the Raman spectral frequencies, intensities, and bandwidths of the internal and external modes as a function of temperature. Anomalous-low frequency (5-200/cm) disorder allowed modes were observed in NH4Cl and NH4Br and a miscroscopic theory was formulated, relating the intensity behavior to the long-range order parameter. Dissert. Abstr.

N74-19151# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AUTOMATIC WAVELENGTH CONTROL OF A FLASH LAMP PUMPED DYE LASER
B. R. Clemesha and V. W. J. H. Kirchhoff May 1972 14 p refs
(INPE-202-RI/003) Avail: NTIS HC $4.00

A technique for automatically tuning a flash lamp pumped dye laser to the sodium D2 line with a precision of + or - 0.01 A. The same technique could be used for tuning to other emission lines for which a monochromatic source of reasonable intensity is available. A slight modification of the method would enable the laser to be accurately tuned within a range of + or - 0.1 A of the given emission line. Author

N74-19152# Stanford Univ., Calif. Microwave Lab.
TUNABLE OPTICAL SOURCES Semiannual Report, 1 Apr. - 30 Sep. 1973
S. E. Harris, R. L. Byer, J. F. Young, R. L. Hebst, D. M. Bloom, M. M. Choy, E. A. Stappaerts, and S. Warshaw Sep. 1973 100 p refs
(Grant DA-ARO(D)-31-124-72-G184; ARPA Order 675)
(AD-771188/0GA; SU-ML-2217; AROD-7580-17-P) Avail: NTIS HC $3.75 CSCL 20/5

The grant supports research into new methods and techniques for the generation of tunable radiation across wide regions of the electromagnetic spectrum. During the past semiannual period progress in both vacuum ultraviolet and tunable infrared generation has been considerable. The report describes the work in both of the above research areas. GRA

N74-19153# Radiation, Inc., Melbourne, Fla. Electro-Optics Operations.
MATERIALS FOR HOLOGRAPHIC OPTICAL ELEMENTS Final Technical Report, 1 Nov. 1972 - 30 Jun. 1973
W. S. Colburn, J. C. Dwyer, and L. M. Ralston Nov. 1973 87 p refs
(Contract F33615-73-C-1090)
(AD-772830; AFAL-TR-73-364) Avail: NTIS CSCL 14/5

The objective of this program was the development of an infrared sensitive recording material suitable for holographic optical elements applications. The major efforts were directed to the IR sensitization of photoplastic materials and the development of an IR sensitive photodegradable material. A theoretical analysis for the spectral sensitization of PVK was developed to further our understanding of the sensitization mechanism and as an aid to estimating the efficiency of particular sensitizers. A number of materials were evaluated in an experimental survey of candidate sensitizers. Several sensitizers were identified that, in complex with polyvinylcarbozole (PVK) formed photoconductors sensitive to 1.15 micrometer radiation. These sensitizers include chloranil, tetranitrofluorenone, and an Eastman Q-Switch dye. Holograms were recorded at a wavelength of 1.15 micrometer with exposure sensitivities as low as 40 (m to the J power)/sq cm. Suitable sensitizers were also identified for use in photodegradable materials. (Modified author abstract) GRA

N74-19154# Stanford Research Inst., Menlo Park, Calif.
STUDY OF NEW CHEMICAL LASER SYSTEMS Final Report, 1 Jan. - 28 Dec. 1973
D. J. Eckstrom, S. A. Edelstein, S. W. Benson, G. Black, and M. Luria 28 Dec. 1973 56 p refs
(Contract DAAH01-73-C-0444; SRI Proj. PYU-2369)
(AD-773031; SRI-MP73-15; RK-CR-73-6) Avail: NTIS CSCL 20/5

Quantitative experimental studies were carried out to measure the degree of electronic state excitation produced in reactions of metal atoms with various oxidizers. The objective is to discover reactions that could lead to an electronic transition chemical laser. Flames of the alkaline earth metals Mg, Ca, Sr, and Ba reacting with F2, Cl2, NOCl, and N2O have been studied at pressures from one to three torr using an evaporation oven as the metal atom source. Diffusion flames of encapsulated metals, consisting of the carbonyls or alkyls of Ni, V, Al, Zn, and Sn,

reacting primarily with F2 were studied at pressures from 0.5 to 5 torr. The Ba - N2O reaction was found to have a photon yield of 10%, and is a good candidate for laser studies. Emission spectra are reported and discussed. GRA

N74-19155# Stanford Univ., Calif. Microwave Lab.
ULTRANARROWBAND TUNABLE DYE LASER FOR NEW APPROACHES TO ATOMIC SPECTROSCOPY Technical Report, 1 Jan. - 31 Dec. 1973
Theodor W. Hansch Dec. 1973 31 p refs
(Contract N00014-67-A-0112-0071; NR Proj. 016-125)
(AD-772556; ML-2252; ML-2141) Avail: NTIS CSCL 20/5

Contents: A simple high-power pulsed nitrogen laser; Linear pressure tuning of a multi-element dye laser spectrometer; Saturation spectroscopy of atoms. GRA

N74-19156# Harry Diamond Labs., Washington, D.C.
DESIGN OF A COMPACT, LIGHTWEIGHT GAS LASER FOR MILITARY APPLICATIONS
Colin S. Willett and Floyd Allen Sep. 1973 25 p refs
(AD-771180/7GA; HDL-TR-1645) Avail: NTIS HC $3.25 CSCL 20/5

A small flashlight-size (17-in. long, 1.75-in. dia., 30-cubic in., 3.5-lb) battery-operated helium-neon gas laser with optimized parameters was designed and constructed. The unit includes nickel-cadmium batteries and will operate as long as one hr on a single battery charge. The laser tube discharge parameters are optimized to give maximum overall efficiency (output power/input power), with the smallest laser configuration practicable while still insuring CW oscillation in the presence of changes in cavity length due to thermal effects. The multimode output power of about 1.25 mW compares favorably with the highest reported power of two mW from a laser tube having a plasma length 20 percent longer and compares well with the 2.6 mW theoretically possible. (Modified author abstract) GRA

N74-19157# American Optical Co., Southbridge, Mass. Research Div.
NEODYMIUM LASER GLASS IMPROVEMENT PROGRAM Final Report, 1 May 1962 - 1 Mar. 1971
Richard F. Woodcock Jul. 1973 135 p refs
(Contract Nonr-3835(00); ARPA Order 306)
(AD-772632; Rept-598-F) Avail: NTIS CSCL 20/5

The report describes work carried out over a nine-year period to improve the properties and performance of Nd-laser glass. One of the first tasks was the reduction of absorption at 1.06 micrometers to a 0.1-0.2%/cm level by the identification and elimination of such impurities as iron. Fluorescent lifetime was investigated. The degree of discoloration due to solarization by the pump source and its effect on laser performance was investigated. Theory was evolved for the design of an athermal laser material based on the hypothesis that thermally induced optical distortion resulting from thermal expansion and associated stress-optical effects can be counterbalanced by direct thermally induced index changes if proper glass composition and cavity design are chosen. Descriptions are given of the measuring techniques for determining coefficients of the above temperature and pressure effects as a function of glass composition. (Modified author abstract) GRA

N74-19158# Hughes Research Labs., Malibu, Calif.
COHERENT OPTICAL ADAPTIVE TECHNIQUES (COAT) Quarterly Technical Report, 27 Mar. - 26 Jun. 1973
P. T. Brunner, S. P. Lazzara, T. A. Nussmeier, T. R. OMera, and T. J. Walsh Jul. 1973 124 p
(Contract F30602-73-C-0248; ARPA Order 1279)
(AD-772639; RADC-TR-73-384; QTR-1) Avail: NTIS CSCL 17/8

Coherent optical adaptive techniques (COAT) can be applied to overcome the deleterious effects of atmospheric turbulence. The report covers the design phase of an experimental program to design, fabricate and evaluate an eighteen-element, self-adaptive, optical phased array. In addition, a computer simulation program developed to aid in system design and performance prediction is also described. Results are presented on preliminary experiments performed with an existing seven-element COAT system. Further experiments were performed with different piezoelectric ceramic phase-shifter configurations and with improved servo control electronic systems and are described here. Techniques for offset pointing of the phased array are discussed. A flexible phase matrix structure is described in which radiating array patterns can be easily changed. Atmospheric characterization measurements performed on the 94 meter test range are described. The design of a dynamic multiglint target system is given. (Modified author abstract) GRA

N74-19159# Naval Postgraduate School, Monterey, Calif.
LASER SCINTILLATION PROPERTIES IN THE MARINE BOUNDARY LAYER M.S. Thesis
Arthur Frederick Schroeder, Jr. Dec. 1973 87 p refs
(AD-772843) Avail: NTIS CSCL 20/6

Intensity scintillation was studied for a He-Ne (6328A) laser beam propagating over a 4.05 kilometer horizontal path in the marine boundary layer. The results fall in three areas. (1) The covariance of the logarithm of the laser beam amplitude increases significantly with decreasing detector aperture diameter for apertures less than the first Fresnel zone size. This effect appears to be dependent on the magnitude of the refractive index structure constant, (C sub N) (2) The dependence of C sub N on (height) to the (-4/3) power for unstable meteorological conditions was verified using the laser beam in determining (C sub N). (3) Frequency analysis performed on scintillation data indicates that the increase of power in higher frequencies is more dependent on the wind velocity perpendicular to the propagation path than on detector aperture diameter for apertures smaller than the first Fresnel zone size. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N74-19160 Arizona State Univ., Tempe.
MICROSCOPIC STRAINS IN DISORDERED BINARY ALLOYS Ph.D. Thesis
Carvin Glenn Shirley 1974 119 p
Avail: Univ. Microfilms Order No. 74-1100

A statistical mechanical analysis which relates X-ray, neutron, or electron diffraction data to a microscopic model of a disordered substitutional binary alloy with atoms of different core radii is presented. The formal analysis applies to a model alloy in which atoms interact by pairwise hard core potentials. The hard core restriction simplifies the analysis and allows it to apply to alloys of arbitrary composition. The diffraction data depends on various correlations among site occupancies and displacements, and it is to the correlations that attention is directed. Correlations involving one or two displacements are related to correlations involving site occupancies only. A set of pair and triplet effective interaction energies from which the site-occupancy correlations may be computed is derived. A closed-form analytical solution to the corresponding one dimensional problem is given in an appendix. Dissert. Abstr.

N74-19161 California Univ., Los Angeles.
THE CRITICAL CRACK-TIP OPENING DISPLACEMENT AND MICROSCOPIC AND MACROSCOPIC FRACTURE CRITERIA FOR METALS Ph.D. Thesis
John Neil Robinson 1973 233 p
Avail: Univ. Microfilms Order No. 74-1584

The development of a fracture criterion which can be related to the load-bearing capability of a structure yet is easily measurable using small inexpensive specimens, even for tough, low-strength materials, is discussed. Because of its potential as a fracture criterion for fracture beyond general yield, particular emphasis has been placed on the measurement of on-load crack tip opening displacement (COD). Special significance has been placed on measuring critical values of plane strain COD at fracture initiation (COD). The most important practical implication of the work is that (COD) can be used to predict strain stress intensity factor. (COD) can be measured on small specimens after general yield. For tough materials, in particular, this use of small specimens

will produce large savings in material, machining time and equipment capacity as compared to the use of conventional methods for strain stress intensity factor measurement.
Dissert. Abstr.

N74-19162 Clemson Univ., S.C.
LOW TEMPERATURE ANNEALING AND IRRADIATION OF TITANIUM Ph.D. Thesis
George Robert Fletcher, Jr. 1973 95 p
Avail: Univ. Microfilms Order No. 73-31842

A study was made of the production of defects in titanium by means of electron irradiation, the annealing of the defects, and the effects of impurities on the production and annealing of defects in titanium. Titanium samples were heated in controlled environments of oxygen, nitrogen, hydrogen, and air. After these samples were cooled to 5K, some were irradiated with electrons which had a kinetic energy of 0.5 MeV and were then isochronally annealed: other samples were isochronally annealed without being irradiated. Heat treatments significantly changed the residual resistivity. It is found that the damage rate in many of the samples may show changes in the residual resistivity which are reproducible, reversible, and independent of radiation-induced damage. The temperature at which these reversible changes occur is strongly dependent upon the heat treatments performed on the titanium samples before isochronal annealing. Dissert. Abstr.

N74-19163 British Steel Corp., London (England).
AN ASSESSMENT OF THE ATMOSPHERIC CORROSION RESISTANCE OF HOT DIPPED GALVANISED STEEL AFTER FIVE YEARS EXPOSURE
R. M. Evans [1973] 18 p refs
(SM/569/C) Copyright. Avail: Issuing Activity

The corrosion of hot dipped galvanised steel has been assessed after five years at four sites viz: an industrial-urban environment (Euston), a severe marine environment (Morfa Bank) an industrial-urban site with both rural and marine influence (Research Centre) and a rural-urban site with some industrial influence (Banbury). Corrosion rates and coating lives were assessed for skyward and groundward facing aspects and for samples exposed in louvred boxes (sheltered from direct contact with rain, wind and atmospheric debris but freely accessible to air.) At the two severest sites (Euston amd Morfa Bank) the loss of coating with time for both skyward and groundward faces displayed rectilinear kinetics; indicative that the frequency of film reparation was sufficient only to maintain the status quo. At the remaining sites (marginally only for the skyward face at the Research Centre) the loss of coating-time curves showed varying degrees of flattening; indicative of the establishment of protective films. The influence of both environment and exposure condition on the corrosion of the zinc coating was examined in the light of operative mechanisms. Author

N74-19164 British Steel Corp., London (England). Strip Mills Div.
A BIBLIOGRAPHY ON VACUUM DEGASSING BY THE RUHRSTAHL-HERAEUS METHOD (1960-1971)
R. L. Davies [1973] 8 p refs
(SM/BIB/795) Copyright. Avail: Issuing Activity

Brief abstracts of 39 articles concerning steel degassing processes are presented. F.O.S.

N74-19165 British Steel Corp., London (England). Corp. Labs.
FIRST REPORT OF THE GROUP ON THE APPLICATION OF THE ATOMIC ABSORPTION SPECTROSCOPIC TECHNIQUE
P. H. Scholes [1973] 21 p refs Supersedes MG/CC/568/72
(MG/CC/650/72; MG/CC/568/72) Copyright. Avail: Issuing Activity

Operational factors in the use of atomic absorption spectroscopy have been studied on a collaborative basis. Sensitivity, limit of detection and noise level, instrument drift, and calibration procedures have each been examined by comparison data obtained using instruments supplied by six manufacturers. Recommendations are made where possible for the achievement of optimum performance in steel industry applications. Author

N74-19166 British Steel Corp., London (England). Strip Mills Div.
SELECT BIBLIOGRAPHY OF THE PUBLISHED LITERATURE ON VACUUM DEGASSING USING THE DORTMUND-HORDER PROCESS (1960-1970)
R. L. Davies [1973] 11 p refs
(SM/BIB/792) Copyright. Avail: Issuing Activity

Brief abstracts of 58 publications on the vacuum process for degassing steel are presented. F.O.S.

N74-19167*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF LONG-TIME, ELEVATED-TEMPERATURE EXPOSURES TO VACUUM AND LITHIUM ON THE PROPERTIES OF A TANTALUM ALLOY, T-111
Robert J. Buzzard and Keith D. Sheffler (TRW, Inc., Cleveland) Washington Mar. 1974 35 p refs
(NASA-TN-D-7548; E-7589) Avail: NTIS HC $3.25 CSCL 11F

The effect of long-term, elevated-temperature vacuum and lithium exposures on the mechanical properties of T-111 (Ta-8W-2Hf) is determined. Exposure conditions were for 1000 hours at 980 or 1315 C, 5000 hours at 1315 C, and a duplex temperature exposure of 1000 hours at 980 C plus 4000 hours at 1040 C. The exposures resulted in reduced tensile and creep strengths of the T-111 in the 900 to 1100 C temperature range where a dynamic strain-age-strengthening mechanism is operative in this alloy. This strength reduction was attributed to the depletion of oxygen from solid solution in this alloy. Author

N74-19168*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUSED SILICON-RICH COATINGS FOR SUPERALLOYS
James L. Smialek Washington Mar. 1974 22 p refs
(NASA-TM-X-3001; E-7704) Avail: NTIS HC $3.00 CSCL 11C

Various compositions of nickel-silicon and aluminum-silicon slurries were sprayed on IN 100 specimens and fusion-sintered to form fully dense coatings. Cyclic furnace oxidation tests in 1 atm air at 1100 C showed all the coatings to be protective for at least 600 hours, and one slurry, Al-60Si, was protective for 1000 hours. This coating also protected NASA TAZ 8A and NASA-TRW VIA for 1000 hours in the same furnace test. Alloys B 1900, TD-NiCr, and Mar-M200 were protected for lesser times, while NX 188 and NASA WAZ 20 were scarcely protected at all. Limited stress-rupture testing on 0.64-cm-diam IN 100 specimens detected no degradation of mechanical properties due to silicon diffusion. Author

N74-19169# Bhabha Atomic Research Centre, Bombay (India).
SPECTROGRAPHIC DETERMINATION OF TRACE IMPURITIES IN MAGNESIUM METAL
G. Krishnamurty, K. S. Gopal, and S. Krishnan 1973 17 p
(BARC-669) Avail: AEC Depository Libraries HC $3.00

An emission spectrographic method is described for the quantitative estimation of seventeen trace impurities in magnesium metal in the concentration range 0.5 to 500 ppM. The spectra are excited in a 10 amp dc arc and are recorded on a Hilger large quartz spectrograph in the region 2410 to 3360 A. Sodium fluoride is used to suppress the intense background. Gallium is used as the internal standard. The mean standard deviation for various elements varies from 10 to 20%. Author (NSA)

N74-19170# Mound Lab., Miamisburg, Ohio.
COMPARISON OF OXYGEN DETERMINATION METHODS FOR Ta-10W ALLOY
H. A. Woltermann, E. B. Nunn, P. L. Redding, R. L. Ryan, J. Y. Jarvis, and R. D. Hamman 13 Nov. 1973 8 p refs
(Contract AT(33-1)-GEN-53)
(MLM-2086) Avail: NTIS HC $4.00

The relative merits of present analytical methods for the determination of oxygen in tantalum alloys were evaluated at Mound Laboratory. Standards were prepared by doping Ta-10 wt% W alloy with approximately 200, 400, 600, and 1000 micrograms oxygen per gram of metal. Methods evaluated included: inert gas fusion using induction heating; inert gas fusion using high amperage current; vacuum fusion; and neutron activation analysis. The inert gas fusion using high amperage

current yielded the best results and the equipment for this method was subsequently modified for use in the analysis of both radioactive and nonradioactive samples. Author (NSA)

N74-19171# Los Alamos Scientific Lab., N.Mex.
PLUTONIUM METALLOGRAPHY
E. M. Cramer 1973 16 p refs Presented at Intern. Metallography Soc. Symp. on Speciment Prep. for Metallography, Los Angeles, Calif., 23 Sep. 1973
(Contract W-7405-eng-36)
(LA-UR-73-1398; Conf-730949-1) Avail: NTIS HC $3.00

An evaluation of the effectiveness of plutonium metallography reveals inadequacies in electrolysis preparation techniques. The probable causes and the approaches to the problems that have been proposed by the participating laboratories over the past two decades are reviewed. A brief history of the metal is included. Author (NSA)

N74-19172# Aerojet Nuclear Co., Idaho Falls, Idaho.
STRAIN FATIGUE AND TENSILE BEHAVIOR OF INCONEL 718 FROM ROOM TEMPERATURE TO 650 C
C. R. Brinkman and G. E. Korth Aug. 1973 17 p refs
(Contract AT(10-1)-1375)
(ANCR-1125) Avail: NTIS HC $4.00

Results of tensile and fully reversed strain-controlled fatigue tests conducted on three heats of Inconel 718 that had been subjected to different solution annealing and aging treatments are presented. Tests were conducted at temperatures ranging from 22 to 650 C with fatigue tests defining behavior over the cyclic range of 100 to 1 million cycles to failure. Average best-fit equations defining true stress-strain, strain-controlled fatigue, and cyclic stress-strain behavior are given for two heat treatments. Heat-to-heat variations in the elevated temperature tensile and fatigue behavior were found. Fatigue lifetime was seen to be dependent upon grain size, particularly at lower strain ranges. Author (NSA)

N74-19173# Argonne National Lab., Ill. Materials Science Div.
GENERALIZED METHOD OF COMPUTING CARBON-DIFFUSION PROFILES IN AUSTENITIC STAINLESS STEELS EXPOSED TO A SODIUM ENVIRONMENT
R. B. Snyder, K. Natesan, and T. F. Kassner Jun. 1973 70 p refs
(Contract W-31-109-eng-38)
(ANL-8015) Avail: NTIS HC $5.45

Numerous experimental observations on the carburization-decarburization behavior of austenitic stainless steels in high temperature flowing sodium have been reported; however, quantitative predictions of carbon diffusion in the steels under specific environmental conditions have been difficult. A mathematical analysis for the process has been developed that incorporates (1) the thermodynamic and kinetic information for carbon in the alloys, (2) the thermal-mechanical treatment of the material (solution annealed versus cold worked) that influences the microstructure, and (3) the carbon concentration in sodium and its dependence on sodium-system parameters. Carbon concentration-distance profiles in Types 304 and 316 stainless steel were generated as a function of time, temperature, and carbon concentration in sodium and compared with experimental data. The analysis was used to evaluate the carburization-decarburization behavior of Type 316 stainless steel fuel cladding exposed to sodium. Author (NSA)

N74-19174# Atomic Energy of Canada Ltd., Chalk River (Ontario). Nuclear Labs.
EFFECT OF SURFACE FILMS ON THE INITIATION OF STRESS CORROSION CRACKING OF ZIRCALOY-2
B. Cox Jun. 1973 24 p refs Presented at 65th Ann. CIC Meeting on the Effects of Surface Films on the Initiation of Stress Corrosion Cracking of Zircaloy-2, Montreal, 4-6 Jun. 1973
(AECL-4589; Conf-730661-1) Avail: AEC Depository Libraries HC $3.25

In aqueous NaCl solution (with anodic polarization) at room temperature, iodine vapor (plus air) at 300 C, and fused nitrate/ chloride (iodide) melts at 300 C, the first step in the degradation of the protective oxide is the growth of a film with abnormal morphology and structure. This film develops porosity which permits direct access of the environment to the metal, followed by subsurface pitting (in some environments). In fused nitrate/ iodide at 300 C, such an abnormal film is not formed, and oxide growth continues until small cracks are generated by the total stress acting on the film. These cracks, and similar ones formed when preoxidized specimens are exposed to the other environments, permit access of the environment to the metal, and the formation of crack nuclei, without the intervention of suboxide pits. The participation of slip-steps in the conversion of pits (or oxide cracks) to propagating stress-corrosion cracks was not established positively. Author (NSA)

N74-19175# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France).
INFLUENCE OF HYDROGEN ON METALS BEHAVIOR. 1. MECHANICAL BEHAVIOR OF Ti-6 PERCENT Al-6 PERCENT V-2 PERCENT Sn ALLOY VERSUS HYDROGEN: INFLUENCE OF HEAT TREATMENT AND OF OXYGEN CONTENT Ph.D. Thesis - Strasbourg Univ., 26 Jun. 1972
Bernard Schaller Oct. 1973 106 p refs In FRENCH
(CEA-R-4472) Avail: AEC Depository Libraries HC $7.50

Effects of H and O on the mechanical behavior of Ti-6% Al-6% V-2% Sn alloy during dynamic testing were investigated. The hydrogen susceptibility depends only slightly on its microstructure, acicular or equiaxed; it depends much more on conditions of hydrogen contamination and on the thermal history afterward. When the alloy has been stabilized by annealing in alpha-beta and provided hydrogen absorption does not induce phase transformations, hydrogen sensitivity is relatively low; brittleness occurs suddenly but at a high concentration threshold (2000 ppM H), which coincides with hydrogen saturation of beta phase. When the alloy includes unstabilized phases, its response to hydrogen changes whether it has been annealed or not; in the 300 to 500 C temperature range it is prone to omega phase formation. In the absence of annealing, a reduction in ductility only occurs at high concentrations (> 1500 ppM H). Author (NSA)

N74-19176# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
INFLUENCE OF GRAIN SIZE ON THE CREEP-RUPTURE AND CREEP-BEHAVIOUR OF THE AUSTENITIC CrNi-STEEL X8 CrNiMo-VNb 1613
H. Scholz Aug. 1973 92 p refs In GERMAN
(KFK-1855) Avail: AEC Depository Libraries HC $6.75

The average grain size of the specimens varied between 2 and 400 micron. The creep tests were performed in the temperature range of 575 to 750 C and at nominal stresses between 22 and 38 kg/sq mm. In addition, tensile tests were performed in order to study strain hardening behavior as a function of the grain size. At a stress of 28 kg/sq mm and a temperature of 650 C the initial strain and the rate of hardening increase with the grain size. For each grain size, the creep rate shows a well-defined minimum, independent of the stress and temperature. The influence of the grain size on the minimum creep rate decreases with increasing temperature. The time to rupture depends on the grain size and passes through a maximum. The time to rupture does not change to the same degree as the minimum creep rate. The 1%-yield time is affected by the grain size to the same extent as the minimum creep rate. Author (NSA)

N74-19177# Oak Ridge National Lab., Tenn.
FATIGUE STRENGTH AND FATIGUE DEFORMATION OF S50C STEEL UNDER RANDOM LOAD
T. Tanaka and S. Xamamoto [1973] 11 p refs Transl. into ENGLISH from Zairyo (Japan) v. 22, no. 237 1973 p 550-555 Sponsored by AEC
(ORNL-TR-2737) Avail: NTIS HC $3.00

A pseudo-random noise generator and a tensile-compressive type electro compressive servo mode fatigue testing machine were used to study the behavior of smooth test pieces of annealed S50C carbon steel under sine wave load and under random load for the doubly vibrating state and for mean stress. Fatigue deformation was also measured in the latter case, and the fatigue behavior under both types of loads was compared and discussed. Results show that the fatigue limits under sine

wave load and under random load were nearly coincident when the fatigue strength was processed in terms of maximum stress. The increase in fatigue deformation for both load types followed the same trend as the creep curve. In the case of strain rate A, it was found that the strain rate obtained by experiment was larger than the strain under random load predicted from the strain rate A under sine wave load and the frequency distribution of peak stress. Author (NSA)

N74-19178# Sandia Labs., Livermore, Calif.
SOME OBSERVATIONS ON THE FORMATION OF SURFACE MARTENSITE IN 304L STAINLESS STEEL
B. C. Odegard Oct. 1973 13 p refs Sponsored by AEC
(SCL-DC-720088) Avail: NTIS HC $3.00

The morphological details as influenced by polishing techniques and thermal quenching are discussed. The quantity of martensite was found to be greatly amplified by the strain energy produced by mechanical polishing. Author (NSA)

N74-19179# Iowa State Univ. of Science and Technology, Ames.
RADIATION HARDENING AND RADIATION ANNEAL HARDENING IN VANADIUM-OXYGEN ALLOYS
M. S. Wechsler, D. G. Alexander, R. Bajaj, and O. N. Carlson 1973 20 p refs Presented at the Conf. on Defects and Defect Clusters in bcc Metals and their Alloys, Gaithersburg, Md., 14 Aug. 1973
(IS-3182; Conf-730813-10) Avail: NTIS HC $3.00

The following were studied: (1) a study of radiation-anneal hardening (RAH) in which the additional hardening upon post-irradiation annealing between 100 and 800 C was observed, as well as the recovery to preirradiation properties, and (2) the effect of irradiation on the temperature dependence of yielding in unirradiated, as-irradiated, and radiation-annealed specimens. The RAH (yield stress increase) occurs over the annealing temperature range of 100 to 400 C, and appears to increase in magnitude with increasing oxygen concentration. Recovery to preirradiation yield stress values takes place at 500 to 700 C. The mechanism proposed is that interstitial oxygen migrates to radiation-produced defect clusters, thus strengthening them as barriers to slip dislocation motion. The temperature dependence of the yield stress was observed over the range of test temperatures from 4 to 400 K. Radiation hardening increased with increasing oxygen concentrations for tests at 195 to 400 K. Author (NSA)

N74-19180# Sandia Labs., Livermore, Calif.
CORROSION OF CF-2042 CABLE
H. R. Johnson Oct. 1973 29 p refs
(Contract AT(29-1)-789)
(SLL-73-52) Avail: NTIS HC $3.50

Corrosion was observed between the copper-plated eyelets and aluminum conductor strip on flat flexible laminated cables of 1100 aluminum and polyimide film bonded together with a fluorocarbon adhesive. It has been determined that the corrosion is caused by, and primarily occurs during, the cyanide copper plating of the eyelets. Plating the eyelets with copper from a pyrophosphate bath eliminates this corrosion.
Author (NSA)

N74-19181# Army Construction Engineering Research Lab., Champaign, Ill.
DIRECTIONAL TRANSFORMATION IN STEEL--TEXTURE BEHAVIOR AND MARTENSITE MORPHOLOGY Final Report
Y. G. Kim, R. Quattrone, and C. M. Wayman Nov. 1973 25 p refs
(DA Proj. 4A0-61101-A-91D)
(AD-771906; CERL-TM-M-58) Avail: NTIS CSCL 11/6

Previous work has shown that certain Fe-Ni-Mn alloys may be suitable for producing an aligned martensite. These alloys are austenitic at room temperature and transform into lath martensite with low Ms and Md temperatures. The work is concerned with the texture behavior of the austenite in Fe -27% Ni -2% Mn and the morphology of the martensite in Fe -25% Ni -2% Mn. The austenitic deformation texture at 200C, 400C, 600C and 800C was found to be (100) (011), which is reported to be a typical deformation texture for bcc metals, but is not known to have ever been previously reported for a fcc material. (Modified author abstract) GRA

N74-19182# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EXPANSION OF SUPERHEATED METALS
Frederick D. Bennett, Henry S. Burden, and Donald D. Shear Nov. 1973 35 p refs
(DA Proj. 1T0-61102-B-11A)
(AD-771061; BRL-1686) Avail: NTIS CSCL 11/6

The report presents optical, high-speed, image-converter photographs of exploding wires of Cu up to the time of arc formation. These are compared with correlated, flash X-ray pictures of experimentally identical explosions. These provide a more definite description than formerly of the process of striation formation and its relation both to the electrical pulse and to the vapor cloud around the wire. The evidence obtained suggests an essential connection between the striations and the vaporization wave. Author (GRA)

N74-19183# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRUCTURAL CHANGES IN Kh18N9T STEEL DURING EXPLOSION WELDING
N. V. Berezina, T. L. Donukic, V. M. Kudinov, P. V. Titov, and L. G. Khandros 30 Nov. 1973 11 p refs Transl. into ENGLISH from Metallofiz. (USSR), no. 40, 1972 p 49-53
(AD-772035; FTD-HT-23-517-74) Avail: NTIS CSCL 11/6

The article examines the special features of the structural changes in the zone around the weld of a Kh18N9T steel-copper bimetal. GRA

N74-19184# Boeing Commercial Airplane Co., Seattle, Wash.
PROGRAM TO IMPROVE THE FRACTURE TOUGHNESS AND FATIGUE RESISTANCE OF ALUMINUM SHEET AND PLATE FOR AIRFRAME APPLICATIONS Final Technical Report, 1 Jul. 1972 - 1 Jul. 1973
Michael V. Hyatt Sep. 1973 214 p refs
(Contract F33615-72-C-1649; AF Proj. 7351)
(AD-772736; D6-60183; AFML-TR-73-224) Avail: NTIS CSCL 11/6

Mechanical, fracture, smooth and notched fatigue, fatigue crack growth rate, and exfoliation corrosion tests were conducted to evaluate the effects of the various thermomechanical treatments. For comparison purposes, data were obtained on the commercial alloys 2024-T3, 7075-T6, 7475-T61, 7475-T761. In addition, a few TMTs on the commercial 7475 alloy were evaluated. (Modified author abstract) GRA

N74-19185# Army Materials and Mechanics Research Center, Watertown, Mass.
EFFECT OF TEXTURE ON THE CREEP AND STRESS RUPTURE PROPERTIES OF TITANIUM 4AI-4V Final Report
Frank S. Hodi Nov. 1973 17 p
(Contract DA Proj. 1T1-61102-B-32A)
(AD-772959; AMMRC-TR-73-49) Avail: NTIS CSCL 11/6

Creep and stress rupture tests were conducted on a textured 4AI-4V titanium alloy. Results indicate a significant difference in these properties with specimen orientation. Greater creep rates are observed in the longitudinally oriented specimens than in the transversely oriented specimens with superior rupture life for transversely oriented specimens. Specimens having a transverse orientation appear to follow the conventional power law for stress dependence of creep where dislocation climb is rate controlling; specimens having a longitudinal orientation appear to follow a stress dependence behavior indicating that dislocation glide may be rate controlling as in alpha zirconium.
Author (GRA)

N74-19186# Army Materials and Mechanics Research Center, Watertown, Mass.
CORROSION BEHAVIOR OF DEPLETED URANIUM-TITANIUM AND URANIUM-MOLYBDENUM ALLOYS
Milton Levy, Chester V. Zabielski, and Gilbert N. Sklover Mar. 1973 27 p refs
(DA Proj. 1T0-62105-A-349)
(AD-772958; AMMRC-TR-73-11) Avail: NTIS CSCL 11/6

The corrosion behavior of U-1.8Mo, U-3.75Mo, U-1.76Ti, U-3.41Ti, and unalloyed uranium has been studied by means of electrochemical measurements. Active-passive behavior was exhibited in sulfuric acid, sodium hydroxide, ammonium hydroxide, sodium sulfate, sodium nitrate, sodium chromate, and ammonium chromate solutions. Chloride additions as small as 0.005M destroyed passivity and caused pitting. Chromates, sulfates, and nitrates behaved as inhibitors in solutions containing low concentrations of chlorides. The uranium-molybdenum alloys were more resistant to corrosion in chloride solutions than the uranium-titanium alloys. Author (GRA)

N74-19187# Naval Ship Research and Development Center, Annapolis, Md.
INFLUENCE OF WATER, SQUALANE, AND METHANOL ON THE MECHANICAL STRENGTH OF A BEARING-TYPE STEEL
P. Schatzberg and J. C. Limpert Jan. 1974 18 p refs
(AD-772505; NSRDC-28-757) Avail: NTIS CSCL 11/6

The influence of water on the mechanical strength of a bearing-type steel was investigated by subjecting thin sheet specimens to uniaxial tensile stress in the presence of various environments. A small chamber kept liquid or gaseous environments in contact with the specimen while it was subjected to tensile stress at cross-head speeds ranging from 0.01 to 0.00005 centimeter per minute. Results showed that the presence of water in the environment, either as a liquid, a gas, or dissolved in a hydrocarbon liquid, significantly reduces the fracture strain of the steel. There exists a trend toward greater embrittlement at lower strain rates, some specimens breaking in the elastic region. The presence of dissolved oxygen in water appears to reduce somewhat the embrittlement at lower strain rates. Dehydrated hydrocarbon liquid causes a lesser but still measurable reduction in fracture strain. Methanol appears to be as aggressive an environment as water. The results are related to other investigations concerned with the influence of moisture on brittle fracture of steel. Author (GRA)

N74-19188# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
TECHNOLOGY DEVELOPMENT FOR TRANSITION METAL RARE EARTH HIGH-PERFORMANCE MAGNETIC MATERIALS Final Technical Report, 30 Jun. 1970 - 30 Jun. 1973
J. J. Becker, M. G. Benz, R. E. Cech, R. J. Charles, M. Doser, S. Foner, E. F. Koch, R. P. Laforce, J. D. Livingston, D. L. Martin et al 30 Jun. 1973 182 p refs
(Contract F33615-70-C-1626; ARPA Order 1617)
(AD-773177; SRD-73-149; AFML-TR-73-238) Avail: NTIS CSCL 11/6

The development of the technology for transition metal-rare earth high-performance magnetic materials that has taken place over the three year contract period is described in this report. This work has covered three general areas: the origin of the coercive force in high-anisotropy materials, phase equilibrium and chemistry, and studies of new materials and processing variables. The coercive force of single particles has been shown to be controlled by defects whose nature determines the behavior of magnetization discontinuities. Magnetic domain observations have been used to measure domain wall energies in several cobalt-rare-earths. The domain behavior of sintered magnets has been observed and correlated with their magnetic properties. (Modified author abstract) GRA

N74-19328 Joint Publications Research Service, Arlington, Va.
METALLURGICAL FEATURES OF PLASMA-ARC REMELTING OF HIGH-ALLOYED STEELS IN WATER-COOLED COPPER CRYSTALLIZER
B. Ye. Paton, V. I. Lakomskiy, G. F. Torkhov, and V. A. Slyshankova *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 71-88 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 71-88 (For availability see N74-19322 10-25)

N74-19333 Joint Publications Research Service, Arlington, Va.
LOW-TEMPERATURE PLASMA AND METAL REDUCING PROCESSES
Yu. V. Tsvetkov and S. A. Panfilov *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 157-167 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 207-214 (For availability see N74-19322 10-25)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N74-19189 University of Southern Calif., Los Angeles.
SPECTROSCOPY AND LASER PROPERTIES OF NEODYMIUM IN YTTRIUM ALUMINUM GARNET AND YTTRIUM ORTHOALUMINATE Ph.D. Thesis
Jayanta Kumar Guha 1973 120 p
Avail: Univ. Microfilms Order No. 73-31646

A comparative study of the spectroscopy and laser properties of neodymium in two of its most common laser hosts; yttrium aluminum garnet (YAG) and yttrium orthoaluminate (YAP) was made. It was found that considerable information about the laser operation in the (F-4)3/2 - (I-4)11/2 group could be obtained from spectroscopic data alone. The cross sections, branching ratios and oscillator strengths for the different transitions in both materials were determined, carefully eliminating sources of error that were not properly corrected by previous workers. These included error in determining the number density, of neodymium atoms, the distribution of atoms in the ground state multiplet, self absorption and resolution of overlapped spectral lines. The peak cross-section of the 1.064 m transition in Nd:YAG was determined to be 8.2 x 10 to the minus 19th power sq cm. It was found that the oscillator strengths in the two crystals were very nearly equal, yet the peak cross-sections of Nd in YAP were found to be considerable greater than those in YAG.
Dissert. Abstr.

N74-19190 Minnesota Univ., Minneapolis.
A STRUCTURE MODEL FOR THE CRYSTALLINE AND AMORPHOUS COBALT-PHOSPHORUS AND NICKEL-PHOSPHORUS ALLOYS Ph.D. Thesis
Y.-S. Tyan 1973 100 p
Avail: Univ. Microfilms Order No. 74-768

A new model for the crystalline and amorphous chemical or electro-deposited iron group metal-phosphorus alloys is developed based on the idea of the grain boundary segregation of phosphorus. The model suggests that the alloys consist of small metal rich grains separated by a monolayer of phosphorus at the boundaries. The extraordinarily high amount of phosphorus in the alloys is due to the excessively high boundary surface area in these fine grained alloys. Dissert. Abstr.

N74-19191 Massachusetts Univ., Amherst.
THERMAL TRANSIENTS IN LAMINATED COMPOSITES Ph.D. Thesis
Arnold Martin Manaker 1973 138 p
Avail: Univ. Microfilms Order No. 73-32184

A semi-infinite laminated composite in which the matrix and filler material are aligned parallel to the heat propagation direction is considered. The face x = 0 of the composite is subject to a heat input of frequency omega and spacewise it has y-periodicity conforming to the periodicity of the layered composite. A rigorous closed-form solution for the temperature distribution in the composite, when a sinusoidal boundary flux (or temperature) is imposed on the free surface, is obtained. As a representative example a nickel matrix and aluminum filler composite is considered. The ensuing temperature distribution throughout the composite is illustrated. Dissert. Abstr.

N74-19192 Northwestern Univ., Evanston, Ill.
SOME CONTACT PROBLEMS OF COMPOSITE MATERIALS IN ELASTICITY Ph.D. Thesis
K.-C. Tsai 1973 72 p
Avail: Univ. Microfilms Order No. 73-30746

The application of dual integral equations to some smooth

contact problems between an elastic layer and a half plane, and the application of dual series equations to the contact between two half planes with sinusoidal surface imperfections is discussed. In the case when the layer is pressed against a half plane by nonsymmetric loading, a pair of homogeneous Fredholm integral equations, coupled through a distance parameter characterizing the relative position between the load and the contact region, results. Contact stresses for this problem are obtained numerically for different material combinations and loaded segments. When two half planes with sinusoidal surface imperfections are pressed together, a pair of dual series equations is obtained that can be reduced to an inhomogeneous Abel integral equation by the introduction of an auxiliary function. Closed form solutions for the extent of contact, contact stresses, and stress concentration factor are obtained. Dissert. Abstr.

N74-19193 Clemson Univ., S.C.
TORSIONAL ANALYSIS OF A COMPOSITE MATERIAL CONTAINING A CAVITY Ph.D. Thesis
Jiunn Shyong Lin 1973 75 p
Avail: Univ. Microfilms Order No. 73-31840

An approximate solution is presented for the torsional analysis of a matrix containing two identical elastic fibers and a cavity between the fibers. The general solution of the governing partial differential equation for the problem is formulated in terms of both integral and series solutions. Satisfaction of the boundary conditions results in a system of integral equations which are reduced to a set of dual integral equations. The singularity for one of the shear stresses is discussed and is found to be independent of cavity length and in the form of the natural logarithm. Numerical results for the shear stresses and displacements are given. It is indicated that the effects of the cavity on shear stresses on the matrix-fiber interface are insignificant at distances greater than half the length of the cavity from the cavity end. Dissert. Abstr.

N74-19194*# Rensselaer Polytechnic Inst., Troy, N.Y.
MATERIALS RESEARCH Semiannual Progress Report, 1 Mar. - 31 Aug. 1973
Nov. 1973 44 p
(Grant NGL-33-018-003)
(NASA-CR-137228) Avail: NTIS HC $5.25 CSCL 11D

The research is reported concerned with materials for aerospace applications. Areas reported include: electrical properties of glasses, oxides and metals; structural and high temperature properties of crystalline and amorphous materials; and physical properties, and microstructure of materials. F.O.S.

N74-19195*# TRW Equipment Labs., Cleveland, Ohio.
RESIN/GRAPHITE FIBER COMPOSITES Final Report, 18 Apr. 1972 - 18 Jun. 1973
P. J. Cavano 15 Mar. 1974 137 p refs
(Contract NAS3-15829)
(NASA-CR-121275; TRW-ER-7581F) Avail: NTIS HC $10.00 CSCL 11D

Techniques were developed that provided thermo-oxidatively stable A-type polyimide/graphite fiber composites using the approach of in situ polymerization of monomeric reactants directly on reinforcing fibers, rather than employing separately prepared prepolymer varnish. This was accomplished by simply mixing methylene dianiline and two ester-acids and applying this solution to the fibers for subsequent molding. Five different formulated molecular weight resins were examined, and an optimized die molding procedure established for the 1500 formulated molecular weight system. Extensive ultrasonic inspection of composites was successfully utilized as a technique for monitoring laminate quality. Composite mechanical property studies were conducted with this polyimide resin at room temperature and after various time exposures in a thermo-oxidative environment at 561 K (550 F), 589 K (600 F) and 617 K (650 F). It was determined that such composites have a long term life in the temperature range of 561 K to 589 K. The final phase involved the fabrication and evaluation of a series of demonstration airfoil specimens. Author

N74-19196# British Steel Corp., London (England). Corporate Labs.
EFFECT OF CHEMICAL COMPOSITION ON NUCLEATION AND CRYSTALLISATION OF SLAG-BASED GLASS-CERAMICS
G. S. F. Hazeldean and D. F. Wichall [1973] 13 p refs
(CH/32/72) Copyright. Avail: Issuing Activity

A description is given of laboratory experiments which were undertaken to investigate the chemical aspects of the production of a glass ceramic material from blast furnace slag. The chemical compositions of glasses produced from melts based on both blast furnace and synthetic slags have been determined with respect to Fe (2 +) total Fe, S (2 -) and total S content as a function of holding time in the furnace. The relationship between the chemical composition of the glass and its crystallisation behavior when subjected to a two-stage heat treatment has been investigated. Two distinct crystal morphologies were observed in the heat-treated specimens and tentative correlations are made between the chemical composition of the glass and the crystal morphology produced on heat treatment. Possible nucleation mechanisms are also proposed. Author

N74-19197*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIRECTIONALLY SOLIDIFIED COMPOSITE SYSTEMS UNDER EVALUATION
Richard L. Ashbrook 1974 25 p refs Presented at Specialists Meeting on Directionally Solidified (in situ) Composites Washington, D. C., 21-25 Apr. 1974; sponsored by AGARD Structures and Mater. Panel
(NASA-TM-X-71514; E-7897) Avail: NTIS HC $4.25 CSCL 11D

The directionally solidified eutectic in-situ composites being evaluated for use as turbine materials range from ductile-ductile systems, where both matrix and reinforcement are ductile, to brittle-brittle systems, where both phases are brittle. The alloys most likely to be used in gas turbine engines in the near term are the lamellar ductile-semi ductile alloys gamma prime-delta, Ni3Al-Ni3Nb and gamma/gamma prime-delta Ni,Cr,Cb,Al/Ni3Al-Ni3Nb and the fibrous ductile-brittle alloys M-MC CoTaC or NiTaC and M-M7C3(Co,Cr,Al)-(Cr,Co)7C3. The results of tests are given which indicate that gamma prime strengthened NiTaC alloys and a (Co,Cr,Al)7C3 have greater tensile strength than the strongest superalloys at temperatures up to about 600 C. The gamma prime-delta and gamma/gamma prime-delta alloys in the Ni,Al,Nb(Cr) systems have greater tensile strength than the superalloys at temperatures greater than 800 C. At low stresses fibrous carbide reinforced eutectic alloys have longer lives at high temperatures than the strongest superalloys. Lamellar delta, Ni3Nb reinforced eutectic alloys have longer lives at high temperatures than the strongest superalloys at all stresses. The experience currently being gained in designing with the brittle ceramics SiC and Si3N4 may eventually be applied to ceramic matrix eutectic in-situ composites. However, the refractory metal fiber reinforced brittle-ductile systems may find acceptance as turbine materials before the ceramic-ceramic brittle-brittle systems. Author

N74-19198*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPERIMENTAL INVESTIGATION OF THE DAMPING CONTRIBUTION OF AN ELASTOMERIC ABLATOR ON ALUMINUM BEAMS
William E. Howell Washington Apr. 1974 21 p refs
(NASA-TM-X-2852; L-8713) Avail: NTIS HC $3.00 CSCL 11D

Damping results are presented for an elastomeric ablation material bonded to an aluminum alloy substrate. Tests were conducted on aluminum beams 0.159, 0.318, and 0.476 cm thick, and with and without an ablator. Ablation-material thickness varied from 0.159 to 0.953 cm. Comparative damping data were obtained by using variations of the free-free beam technique with strain gages and piezoelectric transducers. Of the two test arrangements employed, the technique using strain gages produced results that indicated less restraint of the beams. Ablation material, in thicknesses less than 1 cm, substantially increased the damping parameter of the aluminum beams. Author

N74-19199# Rome Univ. (Italy).
PLASTIC CHAMBERS
M. Conversi, L. Federici, and Q. Taccetti 28 May 1973 21 p

Presented at the Intern. Conf. on Instrumentation for High Energy Phys., Frascati, Italy, 8-12 May 1973
(Conf-730531-10; IN-467) Avail: AEC Depository Libraries HC $3.25

A new kind of electrically pulsed track chamber, composed of sensitive elements of plastic material in which a noble gas mixture flows, is described. Some general features are: ease of obtaining large sensitive volumes of any geometrical shape, very low cost of construction and operation, high efficiency in detecting multitrack events, possibility of recording the information either optically, and in particular by TV systems, or electrically, by means of simple probes which yield pulses that need no amplification. Two particular versions of plastic chambers are described. One of them, made of honeycomb structured polypropylene, is characterized by lack of dead space, minimum amount of low Z insensitive material, space resolution in the mm region, time resolution which can be adjusted from approximatley 0.1 to approximately 10 microseconds per element by varying the rate of gas flow through the sensitive elements. At the preliminary stage of the investigation only recovery times > or = approximately 50 ms were obtained. Author (NSA)

N74-19200# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
AN IMPROVED METHOD FOR THE CHEMICAL ANALYSIS OF HIGH-ALUMINA CERAMICS
R. Walton 5 Oct. 1973 15 p refs
(Contract AT(29-2)-656)
(GEPP-114) Avail: NTIS HC $3.00

A new method of easily and quickly determining the percent alumina in ceramic bases is presented. This new technique fuses the ceramic into a glass pellet with lithium tetraborate, then measures the impurity concentrations using X-ray-emission spectroscopy. This new method requires only eight hours to complete, as compared with 60 hours for the wet chemical technique of ASTM-C-573. Author (NSA)

N74-19201# Oak Ridge Y-12 Plant, Tenn.
LENGTH AND STRAIN-RATE EFFECTS ON THE PROBABILITY OF FAILURE OF TWO BORON REINFORCING MONOFILAMENTS
R. E. Oakes, Jr. 29 Oct. 1973 16 p refs
(Contract W-7405-eng-26)
(Y-1923) Avail: NTIS HC $4.00

Breaking strength data from one-inch gage length specimens and Weibull statistical techniques are used to characterize the probability of failure dependence on the length of brittle tungsten core and carbon core boron monofilaments. Experimental results, using longer gage-section specimens, are in good agreement with the failure probability predicted by the Weibull function. Strain rate effects on the probability of failure of both materials are investigated over the quasistatic range from 0.000033 to 33/sec. Failure probability is shown to be independent of the strain rate for both materials. Author (NSA)

N74-19202# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
MAGNETIC AND ELECTRICAL PROPERTIES OF AMORPHOUS Pd-Co-P ALLOYS
N. I. Marzwell Sep. 1973 42 p refs
(Contract AT(04-3)-822)
(CALT-822-53) Avail: NTIS HC $4.25

The magnetic properties of Pd-Co-P alloys show that they are ferromagnetic with a Curie temperature between 272 and 399 K as the cobalt concentration increases from 15 to 50 at.%. Below 20 at.% Co the short-range exchange interactions are unable to establish a long-range magnetic order and a peak in the magnetization shows up at the lowest temperature range under an applied field of 6.0 KOe. The electric resistivity measurements were performed from liquid helium temperature up to the vicinity of the melting point (900 K). The electrical resistivity of Pd-Co-P shows the coexistence of a Kondo-like minimum with ferromagnetism. The minimum becomes less important as the transition metal concentration increases. The negative magnetoresistivity is a strong indication of the existence of localized moment. Author (NSA)

N74-19203# Oak Ridge National Lab., Tenn.
PLATE-SHAPE VOIDS IN NEUTRON-IRRADIATED BORON CARBIDE
K. H. G. Ashbee and C. K. H. DuBose [1974] 11 p refs
Presented at Symp., on Pore Struct. and Properties of Mat., Prague, 18 Sep. 1973 Sponsored by AEC
(Conf-730938-1) Avail: NTIS

Several processes are known to produce lattice vacancies in sufficient excess of thermal equilibrium concentration that they precipitate out as voids. In the case of certain nuclear transmutations, a solid solution of gas is simultaneously produced at a concentration corresponding to a high equilibrium pressure and, if this gas diffuses into the voids, the equilibrium shape for the void is a thin flat cavity. Transmission electron microscopy was used to examine both the nucleation of such voids in neutron-irradiated boron carbide and their transformation to more compact shapes during fission gas release. Author (NSA)

N74-19204# Sandia Corp., Albuquerque, N.Mex.
THERMAL-SHOCK MODELING OF CARBON FIBER/CARBON MATRIX COMPOSITES
T. R. Guess and B. L. Butler Oct. 1973 21 p refs
(Contract AT(29-1)-789)
(SLA-73-620) Avail: NTIS HC $4.00

A three-dimensional orthogonal micromechanical model that can be used to predict the room-temperature thermal and mechanical properties of continuous filament carbon-carbon composites was developed. The model and the properties of four carbon fibers and four pyrocarbon matrices are used in a parametric study to evaluate the potential thermal shock resistance of various fiber, matrix, volume fraction, and orientation combinations. There is reasonable agreement between limited experimental data for actual carbon-carbon composites and numerical predictions based on the model and constituent properties. Numerical results suggest that graphitized 3D composites of high fiber modulus and low fiber volume will have the greatest thermal shock resistance. Author (NSA)

N74-19205# Dayton Univ. Research Inst., Ohio.
INVESTIGATION OF COMPOSITE-COATING SYSTEMS FOR RAIN-EROSION PROTECTION Final Report, 20 Mar. 1972 - 19 Mar. 1973
Olive G. Engel May 1973 175 p refs
(Contract N00019-72-C-0286)
(AD-772102; UDRI-TR-73-25) Avail: NTIS CSCL 11/3

In a continuation effort to investigate the relative rain-erosion resistance of two-layer composite polyurethane coatings as compared with that of single-layer coatings of the two individual materials, four coating types (single-layer H, single-layer S, composite HS consisting of 9 mils of H applied over 6 mils of S, and composite SH consisting of 9 mils of S applied over 6 mils of H) were prepared. Coatings of the four types were tested for rain-erosion resistance on three different rotating-arm devices and were further subjected to laboratory tests to determine the pressure and loading rate produced at a depth of 15 mils below the surface of the coating by a standard impact. Energy absorbed by the coatings was also determined by making measurements of resilience. Coatings were tested on aluminum and glass fabric laminates. GRA

N74-19206# Newcastle-upon-Tyne Univ. (England). Dept. of Metallurgy.
THE BRITTLE FRACTURE OF ALLOYED ALUMINA Final Technical Report, Apr. 1972 - Mar. 1973
J. P. Chubb and N. J. Petch Jul. 1973 54 p refs
(Contract DAJA37-72-C-3137; DA Proj. 200-61102-B-32D)
(AD-771143; ARDG(E)-E-1420) Avail: NTIS CSCL 11/2

The report concludes a study investigating the thesis that fracture of alumina below 1000C is controlled by dislocation movement, e.g. some plastic deformation is involved in the fracture process. Experimental approach involved inducing barriers to dislocation movement by alloying to effect solid solution hardening, precipitation hardening and non-stoichiometric conditions. Single and polycrystalline alumina samples doped with Cr and Ti were used. The influence of air and vacuum annealing was studied. Testing included four point bend, microhardness, X-ray and magnetic susceptibility. (Modified author abstract) GRA

N74-19207# Martin Marietta Aerospace, Orlando, Fla.
DEVELOPMENT OF CARBON FIBER-RESIN COMPOSITE MATERIALS FOR ADVANCED ABM STRUCTURES Final Report
Howard S. Kliger and Ronald E. Rieckmann Sep. 1973 177 p refs
(Grant DAAG46-73-C-0052; DA Proj. 1W1-62113-A-661)
(AD-772667; OR-12919; AMMRC-CTR-73-44) Avail: NTIS CSCL 11/4

The document reports the results of a research study to evaluate high modulus and high strength graphite epoxy for use as the primary structure for advanced ballistic missiles. The selected materials for this evaluation were the Modmor I and Thornel 300 fibers both impregnated with Fiberite 934 epoxy resin. The study consisted of an analytical optimization of the desired layering sequence and fiber orientation for a selected Advanced Terminal Interceptro design requirement, an evaluation of the basic material characteristics, and the fabrication and testing of subscale cylindrical structures. The results of the study showed that potentially significant weight savings are possible using graphite epoxy composites; however, to fully realize these savings, material and fabricatior processes must be very carefully controlled. (Modified author abstract) GRA

N74-19208# Texas Instruments, Inc., Dallas.
DEVELOPMENT OF INFRARED GLASS FOR RECONNAISSANCE AND WEAPON DELIVERY Final Report, 19 Jun. 1972 - 18 Sep. 1973
Harold C. Hafner Wright-Patterson AFB, Ohio AFAL Jan. 1974 36 p refs
(Contract F33615-72-C-1887; AF Proj. 2001)
(AD-773174; TI-U1-170227; AFAL-TR-73-432) Avail: NTIS CSCL 20/6

A process was developed for producing blanks of three selected glasses in sizes up to 10 inches diameter by 1 inch thick. The three glasses, As40Se60, Ge5S70As25, and Ge10S60As30, were selected on the bases of their optical dispersion characteristics, their resistance to devitrification, and their thermal stability. The refractive index versus wavelength from 1.0 to 12.0 micrometers was determined for all three glasses. MTF measurements were made to evaluate the optical homogeneity of the blanks produced. Author (GRA)

N74-19209# Texas A&M Univ., College Station. Mechanics and Materials Research Center.
STUDIES ON THE VISCOELASTIC BEHAVIOR OF FIBER-REINFORCED PLASTIC Final Report, 1 Jan. 1969 - 31 Dec. 1972
R. A. Schapery, S. W. Beckwith, and N. W. Conrad Jul. 1973 136 p refs
(Contract F33615-70-C-1260; AF Proj. 7342)
(AD-773169; MM-2702-73-3; AFML-TR-73-179) Avail: NTIS CSCL 11/4

A model for microcrack growth in viscoelastic fibrous composites is developed and incorporated into a viscoelastic constitutive theory. The applicability of this crack propagation analysis for predicting the influence of stress history on failure of composites is then examined. Mechanical behavior of a unidirectional graphite fiber-reinforced epoxy (HT-s/ERLA 2256) is characterized in terms of the separate effects of constant and transient temperatures, fiber angle, single and multiple cycle loading, and stress level. The nature of the microstructure and a possible crack arrest mechanism are shown in micrographs obtained with a scanning electron microscope. Author (GRA)

N74-19210# Monsanto Research Corp., St. Louis, Mo.
FORMATION OF EPOXY COMPOSITES FROM SINGLE SHORT FIBERS
Masaharu Takano Dec. 1973 36 p refs
(Contract N00014-67-C-0218; ARPA Order 876;
NR Proj. 356-484)
(AD-772557; HDC-73-164) Avail: NTIS CSCL 11/4

Starting with very low concentrations (v sub f = 0.01), single short fibers can be unidirectionally oriented, statistically overlapped and effectively packed into highly filled, shaped granules or impregnated tapes with concentrations as high as v sub f = 0.6. This packaging of fibers was demonstrated using E-glass, graphite and boron fibers and a binder of epoxy resin. The mechanical properties of the composites formed by molding the granules and tapes of fibers are superior to those reported previously. In particular, the strength utilization factor for E-glass fibers and epoxy resin composites is increased from the normal level (0.25 to 0.55) to a higher level (0.55 to 0.88). (Modified author abstract) GRA

N74-19211# Army Materials and Mechanics Research Center, Watertown, Mass.
EDGE EFFECT STUDIES IN FIBER-REINFORCED LAMINATES
Donald W. Oplinger, Burton S. Parker, and F. P. Chiang Sep. 1973 23 p refs
(DA Proj. 1T0-61102-B-33A)
(AD-772956; AMMRC-TR-73-41) Avail: NTIS CSCL 11/4

Experimental and theoretical studies of edge effects in rectangular composite strips under tension are discussed. The objective of the study was to investigate the effect of various parameters including reinforcement material, fiber orientation, and the structure of the reinforcement on the various quantities which are observed in the vicinity of free edges in multidirectionally reinforced laminates. Experiments consisted of moire measurements of surface displacement patterns which were compared with theoretical predictions, and examination of failure levels. The experiments were carried out on a series of boron- and graphite-reinforced angle ply laminates in which both stacking sequence and fiber orientation were varied parametrically. Moire techniques were developed which allowed observation of displacements on both the wide surface and along the narrow edge of 1 in. wide x 16 ply thick (0.085 in. to 0.105 in.) laminates. (Modified author abstract) GRA

N74-19212# Army Materials and Mechanics Research Center, Watertown, Mass.
EXFOLIATION OF MAGNESIUM-GRAPHITE COMPOSITES: A COMBINED METALLOGRAPHIC AND ANALYTICAL APPROACH
Marc H. Richman (Brown Univ.), Albert P. Levitt, and Eugene DiCesare Jul. 1973 14 p refs
(DA Proj. 1T0-62105-A-331)
(AD-772957; AMMRC-TR-73-29) Avail: NTIS CSCL 11/4

An investigation was conducted to determine and eliminate the cause of localized exfoliation in magnesium and a magnesium alloy (AZ91C) reinforced with graphite fibers. These composites were prepared by liquid phase hot pressing using a titanium intermediate to promote wetting, infiltration, and bonding between the Mg/Mg alloy and the graphite fibers. A multidisciplinary approach involving metallography, scanning electron microscopy, microprobe analysis, electron spectroscopy, infrared spectroscopy and gas chromatography was used to study exfoliated and unexfoliated regions of these composites. The results of these studies indicate that exfoliation in both Mg and the Mg alloy matrix composites occurs when there is poor wetting and bonding and that it can be completely prevented by achieving good wetting bonding. It was also found that eliminating of aluminum as an alloying element improves the suitability of Mg as a matrix for graphite fibers. Author (GRA)

N74-19213# Monsanto Research Corp., St. Louis, Mo.
VISCOSITY EFFECT ON FLOW ORIENTATION OF SHORT FIBERS
Mashharu Takano Dec. 1973 40 p refs
(Contract N00014-67-C-0218; ARPA Order 876)
(AD-772563; HPC-73-165) Avail: NTIS CSCL 11/9

The effects of resin viscosity on the translational and rotational motions of short fibers in concentrated suspensions were studied from cinematographic observation on model systems flowing through uniform and convergent rectangular channels. The channel thickness is comparable to the fiber length. Resin viscosity was varied from 15 to 25,600 poises at room temperature. (Modified author abstract) GRA

N74-19214# Army Construction Engineering Research Lab., Champaign, Ill.
MECHANICAL BEHAVIOR OF VISCOELASTIC MATERIALS Final Report
Dan Naus Dec. 1973 86 p refs
(DA Proj. 4A0-62112-A-891)

(AD-772895; CERL-TR-M-68) Avail: NTIS CSCL 11/9

The objective of this work unit is to provide a better understanding of viscoelastic polymermaterial behavior to permit more efficient use of viscoelastic materials in construction. This is to be accomplished by experimentally investigating the mechanical behavior of polymethyl methacrylate subjected to various load rates, magnitude of load, or magnitude of strain; and, by using the concepts of linear-elastic fracture mechanics to investigate the fracture of viscoelastic materials. GRA

N74-19215# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

FAILURE PROCESS IN METAL MATRIX COMPOSITES

J. E. Alexander and R. G. Carlson 21 Dec. 1973 140 p refs (Contract F33615-72-C-1713; AF Proj. 7351)

(AD-773192; R73AEG428; AFML-TR-73-290) Avail: NTIS CSCL 11/4

Boron/aluminum composites containing 50 v/o of 5.6 mil diameter B in two composite matrix materials (2024Al and 6061Al) consolidated from commercially available and continuous rolled bonded (CRB) tapes, were evaluated in tensile, fatigue, compression, shear, torsion and rupture tests. Failure modes were delineated and an extensive number of salient observations were made. The information contained in the report will advance the state-of-the art in metal matrix composite, enhance the technology base and aid in future evaluation of failure responses in aluminum composites. Author (GRA)

N74-19216# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

ELASTIC-PLASTIC ANALYSIS BY THE HYBRID-STRESS MODEL AND THE INITIAL-STRESS APPROACH Interim Report

Robert L. Spilker Sep. 1973 106 p refs

(Contract DAAG46-73-C-0093; DA Proj. 1B0-62113-A-661) (AD-772933; ASRL-TR-172-1; AMMRC-CTR-73-38) Avail: NTIS CSCL 11/4

A finite-element elastic-plastic incremental procedure for the static analysis of structures whose initially-isotropic material behavior may be elastic, perfectly-plastic or strain hardening has been developed and implemented in a breadboard computer program. The formulation is based on the assumed-stress hybrid model and the initial stress included by modifying the conventional hybrid functional, resulting in a consistently derived equivalent load vector due to the initial stress. Also included in the formulation is an equivalent load term corresponding to the possible compatibility mismatch at each incremental step. The formulation and the corresponding solution procedure are evaluated using a particular plane-stress example, and convergence of the solution is shown. Author (GRA)

N74-19324 Joint Publications Research Service, Arlington, Va.

SEMI-SELF MAINTAINED ELECTRICAL DISCHARGE IN METAL VAPORS AND ITS APPLICATION IN THE PRODUCTION OF COATINGS AND CONDENSATES IN A VACUUM

M. Kh. Shorshorov, M. M. Nikitin, G. N. Klebanov, and A. N. Chadov *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 18-23 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 33-37 (For availability see N74-19322 10-25)

N74-19331 Joint Publications Research Service, Arlington, Va.

SPRAY APPLICATION OF COATINGS

V. V. Kudinov *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 107-143 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 158-187 (For availability see N74-19322 10-25)

N74-19332 Joint Publications Research Service, Arlington, Va.

FEATURES OF PHYSICO-CHEMICAL PROCESSES FOR PLASMA PRODUCTION OF COMPOSITION MATERIALS

N. N. Rykalin, M. Kh. Shorshorov, V. V. Kudinov, and Yu. A. Galkin *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 144-156 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 187-196 (For availability see N74-19322 10-25)

N74-19334 Joint Publications Research Service, Arlington, Va.

SYNTHESIS OF INORGANIC REFRACTORY COMPOUNDS

G. V. Samsonov *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 168-175 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 214-219 (For availability see N74-19322 10-25)

N74-19335 Joint Publications Research Service, Arlington, Va.

PRODUCTION OF SPHERICAL AND FINELY DISPERSED POWDERS IN LOW-TEMPERATURE PLASMA

N. N. Rykalin, V. A. Petrunichev, I. D. Kulagin, L. M. Sorokin, Ye. B. Koroleva, and A. B. Gugnyak *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 176-189 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 220-230 (For availability see N74-19322 10-25)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N74-19217# Cambridge Univ. (England). Dept. of Engineering.

PROOF OF THE TIME-OPTIMALITY OF A PREDICTIVE CONTROL STRATEGY FOR SYSTEMS OF HIGHER ORDER

A. T. Fuller Nov. 1972 15 p refs

(CUED/B-Control/TR-39) Avail: NTIS HC $4.00

For a plant of higher order with a control subject to a saturation constraint, Gulko has given a predictive control strategy which involves the use of nested models operating on fast time scales. In the present paper it is proved that the strategy gives time-optimal transition to the state origin. Author

N74-19218# Cambridge Univ. (England). Dept. of Engineering.

TIME-OPTIMAL CONTROL IN REGIONS WHERE ALL STATE COORDINATES HAVE THE SAME SIGN

A. T. Fuller Nov. 1972 13 p refs

(CUED/B-Control/TR-40) Avail: NTIS HC $4.00

For a plant consisting of pure integrators it is shown that, in the region of state space where all state coordinates have a given sign, the time-optimal control has the opposite sign. This result is generalized to regions where the state coordinates are all non-positive or all non-negative. Corresponding results for more general plants are obtainable. Author

N74-19219# Cambridge Univ. (England). Dept. of Engineering.

NOTES ON SOME PREDICTIVE CONTROL STRATEGIES

A. T. Fuller Oct. 1972 30 p refs

(CUED/B-Control/TR-38) Avail: NTIS HC $4.50

A third-order relay control system, controlled by means of the predictive strategies of Billingsley and Coales (1968), is reviewed. Expressions are given for a separatrix defined by the basic strategy, the switching surface defined by the modified strategy, and the settling time for a step response. The separatrix and some switching surfaces are represented by curves in a reduced state space. The results of the present paper were asserted, but not proved, in a previous paper. Author

N74-19220*# Connecticut Univ., Storrs. Dept. of Electrical Engineering.

A REDUCED ADAPTIVE OBSERVER FOR MULTIVARIABLE SYSTEMS

Robert L. Carroll and D. P. Lindorff Jun. 1973 30 p refs Supersedes N73-28607

(Contract NGL-07-002-002)

(NASA-CR-133429; TR-73-3-c) Avail: NTIS HC $4.50 CSCL 12A

An adaptive observer for multivariable systems is presented

for which the dynamic order of the observer is reduced, subject to mild restrictions. The observer structure depends directly upon the multivariable structure of the system rather than a transformation to a single-output system. The number of adaptive gains is at most the sum of the order of the system and the number of input parameters being adapted. Moreover, for the relatively frequent specific cases for which the number of required adaptive gains is less than the sum of system order and input parameters, the number of these gains is easily determined by inspection of the system structure. This adaptive observer possesses all the properties ascribed to the single-input single-output adpative observer. Like the other adaptive observers some restriction is required of the allowable system command input to guarantee convergence of the adaptive algorithm, but the restriction is more lenient than that required by the full-order multivariable observer. This reduced observer is not restricted to cycle systems. Author

N74-19221# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SELECTED TOPICS IN WAVE PROPAGATION
Istvan Palocz Dec. 1972 153 p
(INPE-238-RI/037) Avail: NTIS HC $10.75

Electromagnetic theory and differentiation of functions with vector variables are discussed. Modal analysis is examined, including field equations in uniform waveguides and orthogonality, normalization, and boundary conditions of vector mode functions. Lossless uniform transmission lines and free resonance applied to surface waves are also considered, as well as a partially filled parallel plate guide. J.A.M.

N74-19222# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
REAL WEINBERG FUNCTION AT POSITIVE ENERGY
V. N. Efimov and G. Shults 1973 22 p refs In RUSSIAN
(JINR-P4-7386) Avail: AEC Depository Libraries HC $3.25

Starting with the fact that in the case of exactly soluble square well potential at positive energies there are real Weinberg functions belonging to both the positive and negative eigenvalues, it is shown that there is a similar situation with the Yukawa potential. The results obtained indicate that any expansion for positive energies in terms of Weinberg functions converges if and only if the eigenfunctions belonging to negative eigenvalues are taken into account. Author (NSA)

N74-19223# Academy of Sciences (USSR), Moscow. Inst. for Physical Problems.
HIGH-ORDER RESONANCES IN THE SOLUTION OF NONLINEAR FINITE DIFFERENCE EQUATIONS
V. Melekhin Toulouse CNRS 1972 5 p refs Presented at the Intern. Colloq. on Point Mapping and its Appl., Toulouse, 10-14 Sep. 1973; sponsored by the Lab. d'Autom. et d'Anal. des Systemes of the CNRS
Avail: NTIS HC $4.00

The method of solution of nonlinear second order point mapping is described. The shape of phase trajectories in critical cases has been found for the arbitrary order nonlinearity. Author (ESRO)

N74-19224# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
RECENT DEVELOPMENTS IN NUMERICALLY STABLE METHODS FOR LINEAR PROGRAMMING
Philip E. Gill Nov. 1973 30 p refs Presented at the IMA Conf. on Computational Problems in Statistics, Essex Univ., Colchester, Engl., Jul. 1973
(NPL-NAC-43) Avail: NTIS HC $4.50

Recent developments in numerically stable methods for linear programming are described, and, in particular, it is demonstrated how methods based on orthogonal factorizations, which are standard in other areas of linear algebra, have been adapted to solve linear programming problems arising in particular situations. ESRO

N74-19225# Osservatorio Astronomico, Rome (Italy). Gruppo di Spettroscopia Solare.
SOME REMARKS ON NON-STATIONARY RANDOM NOISE
F. Sacchetti and D. Trevese Aug. 1973 4 p refs
(RR-9) Avail: NTIS HC $4.00

The autocorrelation function of the processing its Fourier transform are given. In this way, a generalization of the Wiener-Kinchin theorem is obtained, and the effect of the finite measuring time on the power spectrum is discussed. Author (ESRO)

N74-19226# Control Analysis Corp., Palo Alto, Calif.
DIFFUSION APPROXIMATIONS FOR COMPLEX REPAIR SYSTEMS
Donald L. Gilehart and Atam P. Lalchandani Nov. 1973 55 p refs
(Contract N00014-72-C-0266; NR Proj. 347-022)
(AD-771440; TR-266-12) Avail: NTIS CSCL 12/2

For many stochastic models in applied probability, complicated Markov chains arise which are impossible to analyze directly. One approach to this problem is to show that a sequence of Markov chains with appropriate time and state scales converges in distribution to a limiting diffusion process. In these instances, the limiting diffusion process may hold out the only hope for providing useful approximations to practical problems. Here the authors present a heuristic development for convergence to a special class of limiting diffusions: multivariate Ornstein-Uhlenbeck processes. These results are then applied to three complex repair systems. (Modified author abstract) GRA

N74-19227# Wisconsin Univ., Madison. Dept. of Mathematics.
SOME CONTINUATION AND VARIATIONAL METHODS FOR POSITIVE SOLUTIONS OF NONLINEAR ELLIPTIC EIGENVALUE PROBLEMS
Michael G. Crandall and Paul H. Rabinowitz Oct. 1973 34 p refs Prepared in cooperation with Calif. Univ., Los Angeles
(Contract N00014-67-A-0128-0024; Grant NSF GP-38519)
(AD-771724) Avail: NTIS CSCL 12/1

Continuation and variational methods are developed to construct positive solutions for nonlinear elliptic eigenvalue problems. The class of equations studied contain in particular models arising in chemical kinetics, nonlinear heat generation, and the gravitational equilibrium of polytropic stars. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N74-19228 Environmental Protection Agency, Research Triangle Park, N.C. Air Pollution Technical Information Center.
AIR POLLUTION ASPECTS OF EMISSION SOURCES: PETROLEUM REFINERIES; A BIBLIOGRAPHY WITH ABSTRACTS
Jul. 1972 73 p refs
(AP-110) Avail: SOD HC $1.25

Selected abstracts are presented of articles concerning air pollution by petroleum refineries. Subject and author indexes are included. Author

N74-19229 California Inst. of Tech., Pasadena.
DETERMINATION OF OPTIMAL AIR POLLUTION CONTROL STRATEGIES Ph.D. Thesis
Chan Pein Kywan 1 Apr. 1974 213 p
Avail: Univ. Microfilms Order No. 73-31047

One of the important environmental problems facing urban officials today is the selection and enforcement of air pollutant emission control measures. These measures take two forms: long-term controls (multiyear legislation, such as the Federal new car emission standards through 1976) and short-term controls (action taken over a period of hours to days to avoid an air pollution episode). For the long-term control problem, it is assumed that emission control procedures are changed on a year-to-year basis. The problem considered is to determine the set of control measures that minimizes the total cost of control while maintaining specified levels of air quality each year. The problem of determining real-time (short-term) air pollution control strategies for an urban airshed is posed as selecting those control measures such

that air quality is maintained at a certain level over a given time period and the total control imposed is a minimum.
Dissert. Abstr.

N74-19230+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
HARMONIC ANALYSIS OF THE MEAN SURFACE TEMPERATURE OF THE SOUTHERN HEMISPHERE
K. S. Ramamurti, N. JaganMohanaRao, and T. V. RamanaRao Jan. 1973 19 p refs
(INPE-290-RI/079) Avail: NTIS HC $4.00

The surface mean ambient temperature of the Southern Hemisphere along the latitude circles for each 5 deg latitude from the equator to 50 deg S were subjected to harmonic analysis. The amplitude and phase of the first fifteen harmonics are presented, and the seasonal variations are discussed. The fractional contribution of each harmonic to the total variance is analyzed.
Author

N74-19231+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ON FOG FORMATION AT SAO JOSE DOS CAMPOS
N. JaganMohanaRao Jul. 1972 10 p refs
(INPE-213-RI/014) Avail: NTIS HC $4.00

It is observed that stratus clouds are characteristic of the lower part of the atmosphere when a well developed temperature inversion or nearly isothermal layer exists there. If the air below is sufficiently moist, a stratus layer will form, its top at the base of inversion. For fog formation the base of inversion must be at or close to the ground. A temperature inversion at or near the ground suggests cooling from below, and is therefore a characteristic of an airmass that was originally warmer than the surface. The circumstances under which cooling at the surface with high moisture content takes place give the clue for fog formation. Over tropical oceans an inversion in temperature, namely tradewind inversion, is observed, situated usually at 3.0 km. But there is often a level above which the relative humidity drops to low values in spite of the instability. This is shown by a sharp decrease in relative humidity above 800 mb. Considering the lapse rates, the tropical atmosphere is divided into a lower moist and an upper dry layer.
Author

N74-19232+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PRELIMINARY REPORT ON TURBULENCE STUDIES AT BAURU
C. M. Dixit, R. V. Calheiros, and T. V. RamanaRao Sep. 1972 35 p refs
(INPE-246-RI/045) Avail: NTIS HC $4.75

Experiments performed over the city of Bauru, Brazil with pilot balloon ascents are described, and the results obtained through theoretical considerations are presented in a reduced form. Vertical wind structure is depicted which leads to the characteristic Ekman layer between the lowest turbulence level and the geostrophic height. The variation of turbulence coefficient with height is presented.
Author

N74-19233+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A FURTHER NOTE ON THE DYNAMIC INSTABILITY OF ZONAL CURRENT DURING A BREAK MONSOON
N. JaganMohanaRao Jul. 1972 11 p ref
(INPE-212-RI/013) Avail: NTIS HC $4.00

Observations are presented which support the argument that the decrease between easterlies in the south and westerlies in the north, during a break monsoon, increases the instability. Five break monsoon situations were considered during the years 1963 through 1967. It is shown that during the break monsoon, the channel width decreases giving rise to the instability.
Author

N74-19234*# Denver Research Inst., Colo. Industrial Economics Div.
APPLICATIONS OF AEROSPACE TECHNOLOGY IN THE PUBLIC INTEREST: POLLUTION MEASUREMENT
Conrad F. Heins and F. Douglas Johnson Feb. 1974 62 p refs
(Contract NASw-2362)
(NASA-CR-137233) Avail: NTIS HC $6.25 CSCL 13B

This study of selected NASA contributions to the improvement of pollution measurement examines the pervasiveness and complexity of the economic, political, and social issues in the environmental field; provides a perspective on the relationship between the conduct of aerospace R and D and specific improvements in on site air pollution monitoring equipment now in use; describes the basic relationship between the development of satellite-based monitoring systems and their influence on long-term progress in improving environmental quality; and comments on how both instrumentation and satellite remote sensing are contributing to an improved environment. Examples of specific gains that have been made in applying aerospace R and D to environmental problem-solving are included.
Author

N74-19235*# Northrop Services, Inc., Huntsville, Ala.
ESTIMATION OF PEAK WINDS FROM HOURLY OBSERVATIONS
M. E. Graves Mar. 1973 27 p refs
(Contract NAS8-21810)
(NASA-CR-129022) Avail: NTIS HC $4.50 CSCL 04B

Two closely related methods to obtain estimates of the hourly peak wind at Cape Kennedy were compared by statistical tests. The methods evaluated the Monin-Obukhov stability length and the standard deviation of the hourly observed wind speed, so as to augment the latter quantity by F standard deviations. F is an optimized factor. A third method utilizing an optimized gust factor was also applied to the hourly wind. The latter procedure estimated 2952 peak winds with an rms error of 2.81 knots, an accuracy which was not surpassed by the other methods. Peak ground wind speed data were developed for use in space shuttle design operation analyses.
Author

N74-19236# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A PRELIMINARY STUDY OF RAINFALL VARIABILITY IN THE EASTERN PARTS OF BRAZIL
K. S. Ramamurti, N. JaganMohanaRao, and T. V. RamanaRao Jul. 1972 10 p refs
(INPE-222-RI/023) Avail: NTIS HC $4.00

The rainfall patterns of Northeastern Brazil were analyzed using the annual rainfall data for the state capitals. A chart of variation coefficients for the annual precipitation is included.
F.O.S.

N74-19237# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
BRAZILIAN PARTICIPATION IN THE EXAMETNET
Nov. 1972 46 p ref Presented at 8th Ann. Meeting of the Exptl. Inter Am. Meteorol. Rocket Network (EXAMETNET); Mar del Plata, Argentina, Oct. - Nov. 1972 Sponsored by Exptl. Inter Am. Meteorol. Rocket Network (EXAMETNET)
(INPE-254-LAFE) Avail: NTIS HC $5.50

Data from the EXAMETNET Meteorological Rocket Launchings at Barreira do Inferno, are presented for the period June 1971 - September 1972. Eleven successful launchings are reported, all of them for thermodynamic measurements. Two failures occurred in the period.
Author

N74-19238# Joint Publications Research Service, Arlington, Va.
WEATHER FORECASTING
G. Marchuk 1 Mar. 1974 14 p refs Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 11, Nov. 1973 p 10-15
(JPRS-61362) Avail: NTIS HC $4.00

The use of mathematical models of atmospheric physics for long range weather forecasting is discussed. Emphasis is placed upon hydrodynamic models which represent the relationship between the oceans and the atmosphere. Other topics include laser sounding of the atmosphere, solar-atmospheric relationships, and the use of computers.
S.K.W.

N74-19239# National Weather Service, Silver Spring, Md. Systems Development Office.
PREDICTING THE CONDITIONAL PROBABILITY OF FROZEN PRECIPITATION
Harry R. Glahn and Joseph R. Bocchieri Mar. 1974 37 p refs
(NOAA-TM-NWS-TDL-51) Avail: NTIS HC $5.00

A system was developed which produces objective forecasts of conditional probability of frozen precipitation for the conterminous United States. Development of the system consists of two basic steps, in each of which the MOS (Model Output Statistics) concept is used. First, for each of 186 stations, a 50 percent value is found for each of three variables predicted by the National Meteorological Center's Primitive Equation (PE) model. Secondly, the deviations from the 50-percent values are determined for each station for each variable; the relative frequency (for those cases when precipitation occurred) of frozen precipitation is then computed, again with the logit model, as a function of these new variables. In order to get stable results in this last step, data for all stations are combined. A comparative verification on independent data for the 12- and 36-hr forecast projections shows the objective system produced better forecasts than those prepared subjectively at the National Meteorological Center.
Author

N74-19240# National Academy of Sciences - National Research Council, Washington, D.C.
REPORT BY THE COMMITTEE ON MOTOR VEHICLE EMISSIONS
15 Feb. 1973 155 p
Avail: NTIS HC $10.75

The technological feasibility of meeting the motor vehicle emissions standards prescribed by law was investigated. The design, performance, and costs of emission control systems are discussed along with the standards, certification and testing. The potential of spark-ignition internal-combustion engines for passing emission certification for 1975 is analyzed. F.O.S.

N74-19241 Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
METEOROLOGY OF BRAZIL: STUDY IN RETROSPECT
N. JaganMohanaRao Jul. 1972 17 p refs
(Proj. MESA)
(INPE-217-RI/018) Avail: NTIS HC $4.00

Studies on the various aspects of meteorology over Brazil are reviewed. With the planned network increase of stations, all the surface data so far collected is being processed and archived for future use by meteorologists. Special studies, focussing on the 'drought polygon' of Northeast Brazil, can be made by using daily data from the network of stations as recommended by the W.M.D.
Author

N74-19242 Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
FLUCTUATIONS IN STRATOSPHERIC ZONAL WINDS OVER NATAL, BRAZIL
V. BrahamanandaRao, P. Satyamurty, T. V. RamanaRao, and A. DivinoMoura Jul. 1972 16 p refs
(Proj. MESA)
(INPE-218-RI/019) Avail: NTIS HC $4.00

Rocket sonde date from Natal are used to compute the semiannual, annual and quasi-biennial harmonic amplitudes and phases in the zonal wind. The semiannual amplitude is maximum (more than 26 m/sec) at heights near 48 km, the annual component is increasing beyond 52 km and the quasi-biennial component is maximum (more than 21 m/sec) at heights near 26 km. In even years the summer easterly core occured at lower levels whereas in odd years it occured at higher levels. A sharp change in the zonal wind from strong easterly to strong westerly is noticed from summer to autumn.
Author

N74-19243 Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MAXIMUM WIND OVER BRAZIL: TEMPERATURE INTERSECTION METHOD
N. JaganMohanaRao, K. S. Ramamurti, and T. V. RamanaRao Jul. 1972 19 p refs
(Proj. MESA)
(INPE-215-RI/016) Avail: NTIS HC $4.00

Using the upper air temperatures at selected grid points over Brasil, the temperature intersection method is utilized to locate the maximum wind over a selected region of Brazil and its seasonal variation. The results of the preliminary study are presented and discussed.
Author

N74-19244 Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A PRELIMINARY STUDY OF PRECIPITABLE WATER OVER BRAZIL
K. S. Ramamurti, N. JaganMohanaRao, Y. Viswanadham, and T. V. RamanaRao Jul. 1972 17 p refs
(Proj. MESA)
(INPE-216-RI/017) Avail: NTIS HC $4.00

A preliminary study of precipitable water over Brazil is reported. Mean values for January are presented. A regression equation connecting the surface dew point temperature and the precipitable water was derived and the results are presented.
Author

N74-19245# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AN ANALYSIS OF SPATIAL VARIATION OF PRECIPITATION OVER THE AMAZON BASIN IN BRAZIL
K. S. Ramamurti, N. JaganMohanaRao, and T. V. RamanaRao Jul. 1972 11 p refs
(INPE-210-RI/011) Avail: NTIS HC $4.00

A straight line formula for representing the spatial distribution of rainfall in the Amazon basin was studied. It was found that the rainfall can be adequately represented by three parameters. The rainfall has a periodicity of one year with a maximum in January, and minimum in July. F.O.S.

N74-19246# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RAINFALL FLUCTUATIONS-BREAKS-ASSOCIATED SYNOPTIC SYSTEMS
N. JaganMohanaRao Jul. 1972 42 p
(INPE-211-RI/012) Avail: NTIS HC $5.25

Two types of monsoon conditions, active monsoon and break monsoon over a tropical country (India), are studied in detail by using various methods of analysis like cross section, time sections, contour analysis of 700 mb (lever troposphere), 500 mb (middle troposphere) and 200 mb (upper troposphere) and streamline analysis. Consistent results are arrived at in distinguishing the break monsoon condition to that of an active or normal monsoon condition.
Author

N74-19247# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A PRELIMINARY PROGRAMME FOR ANALYSIS OF THE CLIMATOLOGICAL DATA OF BRAZIL FOR THE YEARS 1961 TO 1970 AND ASSOCIATED RESEARCH
K. S. Ramamurti Jul. 1972 20 p refs
(INPE-209-RI/010) Avail: NTIS HC $4.00

Climatological data from Brazil for the years 1961 - 1970 were analyzed for computer processing. The parameters which enter into the analysis of climate are discussed. Suggestions are made for alternative modes of climate analysis. S.K.W.

N74-19248# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A NOTE ON SOME CHARACTERISTICS OF THE FLOW PATTERN IN JANUARY AND JULY OVER THE SUBTROPICS OF SOUTH AMERICAN CONTINENT
V. BrahamanandaRao and R. V. Calheiros May 1972 10 p refs
(INPE-207-RI/008) Avail: NTIS HC $4.00

The possibility is discussed of baroclinic wave development during the summer and winter seasons over the subtropics of the South American Continent. January and July are considered to be representative months for the summer and winter seasons.
Author

N74-19249# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RADAR CLIMATOLOGY OF BRAZIL: A PRELIMINARY STUDY
N. JaganMohanaRao and T. V. RamanaRao Jan. 1973 30 p refs
(INPE-289-RI/078) Avail: NTIS HC $4.50

The variations of atmospheric refractive index computed from meteorological observations are discussed along with the distribution of effective earth's radius factor over Brazil. The values

of microwave refractive index for twenty captial cities of Brazil are computed from meteorological observations (mean monthly values of station level pressure, temperature, relative humidity and saturation vapor pressure for seasonally representative months of 1970). Its annual distribution is also described by using the mean annual values for ten years (1959-68). The variations for the region are described. Author

N74-19250# National Oceanic and Atmospheric Administration, Washington, D.C. Federal Coordinator for Meteorological Services and Supporting Research.
NATIONAL PLAN FOR ROCKETSONDE SUPPORT FOR SPECIAL EVENTS
Feb. 1974 16 p
(FCM-74-4) Avail: NTIS HC $4.00

The procedures are outlined for coordinating and obtaining rocketsonde support from the Cooperative Meteorological Rocket Network stations during a special event. A special event is described as any environmentally related occurrence that is of interest to the scientific community or the investigation of an occurrence which would be beneficial to the U.S. Government. Rocketsonde observations, with their conjunctive rawinsonde observations, provide some or all of the needed environmental data for the analysis of the event. Stratospheric warming is an example of a special event. Author

N74-19251# International Geophysical Year World Data Center A, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA: INTERNATIONAL DELAYED DATA ISSUE. VOLUME 1: HEISS ISLAND, USSR
Natl. Climatic Center 1973 288 p refs Sponsored by NOAA
Avail: NTIS MF $1.45; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations, and current month means and standard deviations are also presented. Author

N74-19252# International Geophysical Year World Data Center A, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA: INTERNATIONAL DELAYED DATA ISSUE. VOLUME 2: VOLGOGRAD, USSR
Natl. Climatic Center 1973 215 p Sponsored by NOAA
Avail: NTIS MF $1.45; National Climatic Center, Federal Building, Asheville, N.C. 28801. Attn: Publications HC $3.00
For abstract, see N74-19251.

N74-19253# International Geophysical Year World Data Center A, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA: INTERNATIONAL DELAYED DATA ISSUE. VOLUME 3: MOBILE SHIP DATA, USSR
Natl. Climatic Center 1973 181 p refs Sponsored by NOAA
Avail: NTIS MF $1.45; National Climatic Center, Federal Building, Asheville, N.C. 28801. Attn: Publications HC $3.00
For abstract, see N74-19251.

N74-19254# International Geophysical Year World Data Center A, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 8, NO. 10, OCTOBER 1971
Natl. Climatic Center 1973 192 p refs Sponsored by NOAA
Avail: NTIS MF $1.45; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $3.00
For abstract, see N74-19251.

N74-19255# International Geophysical Year World Data Center A, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 8, NO. 11, NOVEMBER 1971
Natl. Climatic Center 1973 212 p refs Sponsored by NOAA
Avail: NTIS MF $1.45; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $3.00
For abstract, see N74-19251.

N74-19256# International Geophysical Year World Data Center A, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 8, NO. 12, DECEMBER 1971
Natl. Climatic Center 1973 195 p refs Sponsored by NOAA
Avail: NTIS MF $1.45; National Climatic Center, Federal Building, Asheville, N.C. 28801. Attn: Publications HC $3.00
For abstract, see N74-19251.

N74-19257# National Weather Service, Silver Spring, Md. Weather Analysis and Prediction Div.
NATIONAL WEATHER SERVICE, MAY 1971 - APRIL 1972 PUBLIC FORECAST VERIFICATION SUMMARY
Alexander F. Sadowski and Geraldine F. Cobb Apr. 1974 29 p refs
(NOAA-TM-NWS-FCST-19) Avail: NTIS HC $4.50

Performance scores for May 1971 - April 1972 of guidance from the National Meteorological Center (NMC) and state forecasts from the Weather Service Forecast Offices (WSFOs) are summarized. The small improvement by the succeeding echelon is evident again, and most show better scores than previous years. NMC has the best resolution for the second and third period precipitation forecasts during May 1971 - October 1971, but WSFOs did better in November 1971 - April 1972. Both echelons continue to have a small bias of underforecasting temperatures for all periods. Author

N74-19258# International Geophysical Year World Data Center A, Washington, D.C.
HIGH ALITUDE METEOROLOGICAL DATA. INTERNATIONAL DELAYED DATA ISSUE. VOLUME 4: MOBILE SHIP DATA USSR
Asheville, N. C. 1973 206 p Sponsored by NOAA
Avail: NTIS MF $1.45; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density and speed of sound. Local radiosonde observations, and current month means and standard deviations are also presented. Author

N74-19259# International Geophysical Year World Data Center A, Washington, D.C.
HIGH ALTITUDE METEOROLOGICAL DATA. INTERNATIONAL DELAYED DATA ISSUE, VOLUME 5 Data Report
Asheville, N. C. 1973 197 p Sponsored by NOAA
Avail: NTIS HC $1.45; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $3.00
For abstract, see N74-19258.

N74-19260# National Weather Service, Silver Spring, Md. Techniques Development Lab.
SPLASH (SPECIAL PROGRAM TO LIST AMPLITUDES OF SURGES FROM HURRICANES). PART 2: GENERAL TRACK AND VARIANT STORM CONDITIONS
Chester P. Jelesnianski Mar. 1974 60 p refs
(NOAA-TM-NWS-TDL-52-Pt-2) Avail: NTIS HC $6.00

An operational computer program has been expanded to accommodate storms with generalized motions of not too great complexity. Examples are storms that move along-shore, recurve, remain stationary, accelerate, and landfall (exit). Also, storm strength and size are allowed to vary in a continuous monotonic manner with time. Surges generated by these generalized storms are complicated in space and time, and they can occur on an extensive coastline (hundreds of miles). Five track positions (spaced at 6-hr increments on the storm path) and simple meteorological parameters are the meteorological input for the program. Detailed meteorological phenomena such as explosive deepening of storms, violet changes in storm track, and sudden accelerations of the storm are not considered. Also discussed in a qualitative and heuristic manner are several strange dynamic phenomena generated by the storms with generalized motions. Several special examples are computed by the program and then interpreted for forecasting. Author

N74-19261# Bureau of Meteorology, Canberra (Australia).
THE DARWIN THUNDERSTORM TURBULENCE STUDY,

FEBRUARY 1969
Bettye Macnicol and M. Thomson Apr. 1973 76 p refs
(Meteorol-Study-23) Avail: NTIS HC $7.00

Results of measurements of aeronautical turbulence within tropical thunderstorms are presented and discussed in relation to concurrent 10 cm weather-radar echoes. Using an objective method of estimating turbulence intensity, a significant correlation was found to exist between the turbulence intensity and both the maximum reflectivity of the storm core and also the maximum reflectivity beneath the flight path. However no significant correlation was apparent between the reflectivity gradient encountered within the storm and the turbulence intensity.
Author

N74-19262# Argonne National Lab., Ill.
REDUCTION OF ATMOSPHERIC POLLUTION BY THE APPLICATION OF FLUIDIZED-BED COMBUSTION AND REGENERATION OF SULFUR-CONTAINING ADDITIVES Annual Report, Jul. 1971 - Jun. 1972
G. J. Vogel, E. L. Carls, J. Ackerman, M. Haas, J. Riha, C. B. Schoffstoll, J. Hepperly, and A. A. Jonke Jun. 1973 73 p refs
(Contract W-31-109-eng-38)
(ANL/ES-CEN-1005; EPA-R-2-73-253) Avail: NTIS HC $5.45

Fluidized-bed combustion was studied as a means of removing from the gas phase nearly all of the atmospheric pollutants (sulfur and nitrogen compounds) generated during the combustion of fossil fuels. Particulate lime solids (additives) are introduced into the fluidized bed and react with the sulfur compound formed during combustion. Information has been obtained on (1) pollution control by fluidized-bed combustion of oil with an excess of air and by the combustion of coal with a deficiency of air, (2) the thermodynamics of several proposed processes for regenerating additives, and (3) experimental regeneration of sulfur-containing additive by the two most promising processes - a one-step reductive decomposition of CaSO4 and a two-step (reduction-CO2/H2O regeneration) procedure. Author (NSA)

N74-19263# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Sep. 1973 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, SEPTEMBRE 1973]
Sep. 1973 15 p In FRENCH and DUTCH
Avail: NTIS HC $4.00

Meteorological parameters observed at different Belgian weather stations during September 1973 are given. ESRO

N74-19264# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Nov. 1973 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, NOVEMBRE 1973]
Nov. 1973 16 p In FRENCH and DUTCH
Avail: NTIS HC $4.00

Meteorological parameters observed at different Belgian weather stations during November 1973 are given. ESRO

N74-19265# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Dec. 1973 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, DECEMBRE 1973]
Dec. 1973 16 p In FRENCH and DUTCH
Avail: NTIS HC $4.00

Meteorological parameters observed at different Belgian weather stations during December 1973 are given. ESRO

N74-19266# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION. PART 1: SMOKE AND SULFUR DIOXIDE. PART 2: PRECIPITATION MEASUREMENTS USING STORAGE GAGES Monthly Bulletin, Jan. 1973 [POLLUTION ATMOSPHERIQUE I. FUMEE ET ANHYDRIDE SULFUREUX II. MESURE DES RETOMBEES AU MOYEN DES JAUGES DE DEPOT BULLETIN MENSUEL, JANVIER 1973]
Jan. 1973 37 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
Avail: NTIS HC $5.00

Data obtained at Belgian weather stations for January 1973 are tabulated. The air pollution apparatus and rain gage are briefly described. ESRO

N74-19267# Southwest Research Inst., San Antonio, Tex. Dept. of Automotive Research.
EXHAUST EMISSIONS FROM UNCONTROLLED VEHICLES AND RELATED EQUIPMENT USING INTERNAL COMBUSTION ENGINES. PART 4: SMALL AIR-COOLED SPARK IGNITION UTILITY ENGINES Final Report
Charles T. Hare and Karl J. Springer May 1973 113 p refs
(Contract EPA-70-108)
(PB-224885/4GA; SWRI-AR-888-Pt-4; APTD-1493) Avail: NTIS HC $6.75 CSCL 13B

Exhaust emissions from five gasoline-fueled, aircooled utility engines were measured using two types of steady-state procedures, and some measurements were taken during transient operation. The engines included one and two cylinder, two and four stroke models with 2 to 18 hp. The two procedures used for small engine tests were a 9-mode procedure which was being recommended by SAE at the time the tests were run (early 1971), and a modified version of the EMA-California 13-mode procedure. The exhaust products measured included hydrocarbons, CO, CO2, O2, light hydrocarbons, total aliphatic aldehydes, formaldehyde, particulate, exhaust smoke. The engines were operated on small electric dynamometers, and the emissions results are used in conjunction with statistics on utility engine population and usage to estimate national emissions impact. (Modified author abstract) GRA

N74-19268# TRW Systems Group, Redondo Beach, Calif.
A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOLUME 7: A USER'S MANUAL AND GUIDE TO THE ECONOMIC EFFECTIVENESS COMPUTER PROGRAM Final Report
Jul. 1973 385 p refs Sponsored by EPA and Coordinating Res. Council, Inc. 8 Vol.
(PB-225161/9GA; CRC-APRAC-CAPE-13-68-15-Vol-7) Avail: NTIS HC $8.00 CSCL 13B

This manual presents a detailed description of the Economic Effectiveness Computer program. The program provides a generalized methodology for simulating the dynamic behavior of alternative vehicle inspection and maintenance procedures. The model has been coded in FORTRAN 4 and is currently operating on a CRC 6500 System. The manual describes for the programmer/user the operating instructions required to use the program in a variety of operating modes. It is composed of five sections and two appendices which provide a discussion of the model's mathematical framework, input requirements and data formats, program debugging and output options, and a complete list of flow schematics and computer listings. GRA

N74-19269# TRW Systems, San Bernardino, Calif. Transportation and Environmental Operations.
A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOLUME 8: EXPERIMENTAL CHARACTERIZATION OF VEHICLE EMISSIONS AND MAINTENANCE STATES Final Report
Jul. 1973 203 p refs Sponsored by EPA and Coordinating Res. Council, Inc. 8 Vol.
(PB-225026/4GA; CRC-APRAC-CAPE-13-68-16-Vol-8) Avail: NTIS HC $5.50 CSCL 13B

Data are presented which describe the rate of engine adjustment and exhaust emission deterioration with time and mileage. Three classes of vehicles are described which include pre 1966 cars without exhaust emission controls, 1966-1970 cars with HC and CO exhaust controls and post 1970 cars that are equipped to control HC, CO and NOx. The results of additional experiments to determine the repeatability of emissions measurements and the effect of cold soak temperature upon measured exhaust emission are also presented. Mass emission measurements were made using the 1972 Federal Test Procedure and concentration measurements were made in selected engine operation modes. GRA

N74-19270# Aerojet Electrosystems Co., Azusa, Calif.
METEOROLOGICAL APPLICATIONS OF PASSIVE MICROWAVE RADIOMETRY. VOLUME 2: METEOROLOGICAL AND PHYSICAL BACKGROUND Final Report, 1 Jul. 1972 - 30 Jun. 1973
Dennis H. Quine, Vincent J. Falcone, and Herb Pascaler Nov. 1973 92 p refs 3 Vol.
(Contract F04701-72-C-0227; AF Proj. S136)
(AD-771773; SAMSO-TR-73-206-Vol-2) Avail: NTIS CSCL 04/2

The study defined the capabilities for atmospheric profiling achievable with spaceborne passive microwave sensors based on current technology. This volume, volume 2, serves as an introductory volume to the application of microwave sensors in meteorology. This volume discusses the prediction problem, namely: (1) collecting sufficient data over a large enough area to specify the initial state of the atmosphere, (2) understanding the processes by which the initial state will evolve into later stages, (3) developing suitable numerical calculation techniques and the resultant computing complexity, and (4) the ultimate limits to predicting accuracy. (Modified author abstract) GRA

N74-19271# Stanford Research Inst., Menlo Park, Calif.
PAPERS PRESENTED AT THE LIGHTNING AND STATIC ELECTRICITY CONFERENCE (1972). STRUCTURE OF LIGHTNING NOISE - ESPECIALLY ABOVE HF. TRIGGERED LIGHTNING AND ITS APPLICATION TO ROCKETS AND AIRCRAFT
N. Clanos, G. N. Oetzel, and Edward T. Pierce Dec. 1973 20 p refs
(Contract N00014-71-C-0106; SRI Proj. 4454)
(AD-771464; SN-20) Avail: NTIS CSCL 04/1

The document contains two reports; one which summaries the characteristics of the radiation fields due to lightning and the other discusses lightning initiated by high-rise buildings, aircraft or rockets. GRA

N74-19272# Stevens Inst. of Tech., Hoboken, N.J.
ANALYTIC SOLUTION OF COUPLED MODE EQUATIONS BY COMPUTER Final Technical Report, 20 Dec. 1971 - 31 Mar. 1973
Bernard Rosen 7 Dec. 1973 55 p refs
(Grant DA-ARO(D)-31-124-72-G73; ARPA Order 1992)
(AD-772828) Avail: NTIS CSCL 04/2

The author uses automated symbolic manipulation to generate approximate solutions to the prognostic equations of meteorology. These equations are treated in the form that would arise by means of modal analysis and truncation. Consequently the equations take the form of coupled non-linear first-order ordinary differential equations; the number of such equations may be very large if many modes are included in the analysis. The work was performed in conjunction with an extensive program to investigate climate prediction and modification. Also of interest is the long term behavior of the atmosphere under the influence of the driving force of the sun. GRA

N74-19273# Naval Postgraduate School, Monterey, Calif.
A CASE STUDY ON THE USE OF DIGITIZED CLOUD BRIGHTNESS DATA TO REPRESENT LARGE SCALE CONVECTION IN THE TROPICS M.S. Thesis
Bruce B. Edwards Dec. 1973 51 p refs
(AD-772742) Avail: NTIS CSCL 04/2

Digitized cloud brightness data for July 1969 are examined to determine the degree of relationship between organized brightness patterns and the large-scale convection field in the tropical western North Pacific. Correlation coefficients between kinematically computed vertical motion fields and cloud brightness are generally low, except for a few notable days. Examination of time-longitude sections reveals a close association between propagating brightness patterns and vertical motion fields, indicating that the former are reflections of synoptic wave passages, rather than simply inactive clouds advected by zonal flow. In view of the potential usefulness of such satellite data, a technique is proposed that uses satellite cloud data to objectively determine the large-scale tropical flow. (Modified author abstract) GRA

N74-19274# New York Univ., N.Y.
ON BALANCE AND INITIALIZATION
Michael Ghil Dec. 1973 37 p refs
(Grant DA-ARO(D)-31-124-72-G113; ARPA Order 2069)
(AD-772501; IMM-400) Avail: NTIS CSCL 04/1

The initialization problem is defined as the problem of obtaining the initial data that are required in order to solve a well posed initial-and-boundary-value problem for the equations of large scale dynamical meteorology. The methods used are based on the exact mathematical treatment of the differential equations of atmospheric motion, rather than on perturbation-type or numerical methods. A simple solution of the initialization problem thus formulated is exhibited in a particular case. It is shown, however, that in general the problem is indeterminate and additional information is required to uniquely find the velocity field. Four-dimensional data assimilation is also discussed. (Modified author abstract) GRA

N74-19275# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A HIGH-ORDER INTERPOLATION PROCEDURE FOR USE IN FINE-MESH LIMITED-AREA MODELS
Ralph Shapiro 21 Aug. 1973 25 p refs
(AF Proj. 8604)
(AD-772658; AFCRL-TR-73-0543; AFCRL-PSRP-560) Avail: NTIS CSCL 04/2

A high-order interpolation procedure is proposed for supplying initial and boundary values in fine-mesh limited-area models. The procedure recognizes and compensates for the fact that low-order interpolation such as linear interpolation has a strong damping effect, particularly on the shorter-wavelength features of the field. Starting with linear interpolation, a general operator of arbitrary order is developed for the purpose of restoring as much of the damped information as possible for any particular order of interpolation without amplifying any spectral component beyond its original value. Numerical simulation experiments in a nested region whose gridspacing is one-fifth that of the coarse grid are performed with an eight-level primitive equation model to compare the solution obtained by means of two-point linear interpolation with the solution obtained by means of the eight-point ideal interpolation operator. (Modified author abstract) GRA

N74-19276# Army Foreign Science and Technology Center, Charlottesville, Va.
SOME RADIONAL PROPERTIES OF FOGS
I. V. Koshelenko 7 Dec. 1973 7 p refs Transl. into ENGLISH from Inform. Byul. Mizhvidomchyi Geofiz. Kom., Akad. Nauk USSR (Kiev), no. 12, 1957 p 81-85
(AD-772460; FSTC-HT-23-2368-72) Avail: NTIS CSCL 04/1

The paper presents experimental data on albedo and discharged and absorbed radiation, depending on fog thickness and water content. Results are compared with some theoretical data. GRA

N74-19277# State Univ. of New York, Albany.
STRUCTURE AND MODIFICATION OF CLOUDS AND FOGS Final Report, 12 Sep. 1967 - 30 Sep. 1973
Bernard Vonnegut Sep. 1973 23 p refs
(Contract F19628-68-C-0057; AF Proj. 7922)
(AD-772821; AFCRL-TR-73-0532) Avail: NTIS CSCL 04/2

The report summarizes studies on physical and chemical processes occuring in the atmosphere. GRA

N74-19278# Nevada Univ., Reno. Lab. of Atmospheric Physics.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE PHYSICS OF WARM CLOUDS Final Report, 10 Sep. 1967 - 31 Aug. 1972
Robert D. Barczewski, Frederick B. Brown, Richard Hanaway, John Presley, and James W. Telford 7 May 1973 185 p refs
(Contract F19628-68-C-0059; AF Proj. 7922)
(AD-772635; AFCRL-TR-73-0328) Avail: NTIS CSCL 04/1

A discussion of the chronological devleopment of the Themis Project at the University of Nevada over the five year period of development is presented. As background, an analysis is given of the measurement of air motion including accuracies required

for the study of atmospheric convection and for the calculation of the fluxes of heat, moisture, and momentum. Design criteria are outlined. Detailed descriptions of the inertial platform, sensor development, system integration and testing, supporting activities, theoretical studies and specific field measurement activities are included. Joint and cooperative research activities are acknowledged. Distinct accomplishments in the development of airborne research instrumentation and increasing our knowledge of cumulus cloud formation and of air motion in the lower layers of the atmosphere are described. Implications and specific suggestions for additional research are provided. Author (GRA)

N74-19279# Systems Science and Software, La Jolla, Calif.
THE EFFECTS OF MESO-SCALE AND SMALL-SCALE INTERACTIONS ON GLOBAL CLIMATE Semiannual Technical Report, 17 Apr. - 15 Oct. 1973
7 Jan. 1974 86 p refs
(Contract DAHC04-73-C-0003; DARPA Order 1752)
(AD-772490; SSS-R-74-2023) Avail: NTIS CSCL 04/2

The report discusses the reorganization and reading of a 3-D, linear, steady-state computer code based on the Bretherton formulation. A discussion of the numerical method is included and results of a study of the Sierra Nevada-Owen's Valley region in north-central California is presented. Modification of the Bousinesq hydro-code STUFF used in atmospheric research of turbulence is also presented. GRA

N74-19280# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: WESTERN EUROPEAN COASTAL MARINE AREAS. VOLUME 1: AREA 1, LISBON; AREA 2, AVEIRO; AREA 3, PORTO; AREA 4, LA CORUNA; AREA 5, GIJON; AREA 6, BORDEAUX
Jan. 1974 485 p
(AD-773141) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. Areas along the Atlantic Seacoast of Portugal, Spain, and southern France are discussed in the report. GRA

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N74-19281# National Aeronautical Establishment, Ottawa (Ontario).
MODIFICATION OF V/STOL INSTRUMENT APPROACH GEOMETRY AS A MEANS OF COMPENSATING FOR ALONG-TRACK WIND EFFECTS
W. S. Hindson and D. G. Gould Jan. 1974 29 p
(NRC-13842; LR-573) Avail: NTIS HC $4.50

The influence of wind on the low speed approach and landing operation of V/STOL aircraft is investigated. The problems which may require specific solutions for V/STOL aircraft are discussed. A method to allow for significant along-track wind effects, including shears, is proposed. The method is based on modifying the approach geometry relative to the earth according to the ambient wind condition. Author

N74-19282*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT AND FLIGHT TESTS OF A GYRO-LESS WING LEVELER AND DIRECTIONAL AUTOPILOT
H. Douglas Garner and Harold E. Poole Washington Apr. 1974 53 p refs
(NASA-TN-D-7460; L-9229) Avail: NTIS HC $3.75 CSCL 01B

A gyro-less wing leveler and directional autopilot were developed and flight tested in a single-engine light airplane. The primary purpose of the project was to develop a simple, reliable, low-cost stability augmentation and autopilot system for light aircraft. The wing leveler used a fluidic inertial rate sensor, electronic signal processing circuitry, and vacuum operated servos. A strap-down magnetic heading reference of simple design provided the wing leveler with directional autopilot capability. Flight tests indicated that the performance of the gyro-less wing leveler was equal to that of a commercial wing leveler using a gyroscopic rate sensor. Drift-free, long-term, heading-hold capability of the magnetic heading reference was demonstrated. Author

N74-19283# Royal Aircraft Establishment, Farnborough (England).
APPLICATION OF MONTE CARLO METHODS TO ESTIMATION OF COLLISION RISKS ASSOCIATED WITH ATC SEPARATION STANDARDS
D. E. Lloyd and P. P. Scott Jun. 1973 46 p refs
(RAE-TR-73104; BR37072) Avail: NTIS HC $5.50

This risk can be estimated in several ways, one of which is to assign each indeterminate quanity a probability distribution and use Monte Carlo methods to combine these, giving a distribution of risk. An example of these methods, to the safety assessment of a proposed 90 mile lateral separation standard for North Atlantic jet aircraft is also presented. Author (ESRO)

N74-19284# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
TRANSIENTS IN HIGH SPIN GYROSCOPIC SYSTEMS
P. R. Sethna and M. Balachandra Nov. 1973 25 p refs
(Grant AF-AFOSR-2284-72)
(AD-772769; AFOSR-73-2277TR) Avail: NTIS CSCL 17/7

Except for certain classical solutions for the top, general nonlinear gyroscopic systems have not had much attention. The authors consider transient motions in a general class of nonlinear gyroscopic systems with a large spin parameter. GRA

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N74-19285*# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
DIAGNOSTICS OF SEEDED RF PLASMAS: AN EXPERIMENTAL STUDY RELATED TO THE GASEOUS CORE REACTOR Final Report
S. D. Thompson, J. D. Clement, and J. R. Williams 11 Feb. 1974 135 p refs
(Grant NGR-11-002-146)
(NASA-CR-137243) Avail: NTIS HC $9.75 CSCL 18I

Measurements of the temperature profiles in an RF argon plasma were made over magnetic field intensities ranging from 20 amp turns/cm to 80 amp turns/cm. The results were compared with a one-dimensional numerical treatment of the governing equations and with an approximate closed form analytical solution that neglected radiation losses. The average measured temperatures in the plasma compared well with the numerical treatment, though the experimental profile showed less of an off center temperature peak than predicted by theory. This may be a result of the complex turbulent flow pattern present in the experimental torch and not modeled in the numerical treatment. The radiation term cannot be neglected for argon at the power levels investigated. The closed form analytical approximation that neglected radiation led to temperature predictions on the order of 1000 K to 2000 K higher than measured or predicted by the numerical treatment which considered radiation losses. Author

N74-19286# National Bureau of Standards, Washington, D.C. Reactor Radiation Div.
NBS REACTOR: SUMMARY OF ACTIVITIES, JULY 1972 - JUNE 1973 Interim Report

Robert S. Carter Feb. 1974 137 p refs
(NBS-TN-813) Avail: SOD HC $1.55 as C13.46:813

The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, and radiation effects studies. Author

N74-19287*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMIONIC PERFORMANCE OF A VARIABLE-GAP CESIUM DIMINIODE WITH A 110-SINGLE-CRYSTAL-TUNGSTEN EMITTER AND A POLYCRYSTALLINE-NIOBIUM COLLECTOR
James F. Morris, Arthur L. Smith, and Eugene J. Manista Washington Mar. 1974 18 p refs
(NASA-TM-X-2953; E-7568) Avail: NTIS HC $3.00 CSCL 18H

Results from tests of the first variable-gap diminiode at an initial interelectrode spacing of 0.23 millimeter indicate sharply defined, relatively low ultimate power points. This characteristic supports the value of the diminiode as a well-controlled tool for thermionic-conversion research and development. Author

N74-19288# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte System-Technik und Reaktorphysik.
BEHAVIOR OF AEROSOLS IN CLOSED CONTAINERS (PARDISEKO-2)
K. Keller Aug. 1973 21 p refs In GERMAN
(KFK-1758) Avail: AEC Depository Libraries HC $3.25

An aerosol model was developed and a corresponding computers program (PARDISEKO 2) which permits prediction of the time behavior of aerosols is closed containers (reactor containments) was written. The model includes the following elementary aerosol-mechanical processes: coagulation due to Brownian motion, diffusion to the walls of the container, sedimentation, thermophoresis at the containment walls and a continuous time independent source. The model achieves satisfactory agreement with experiments. Author (NSA)

N74-19289# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
THERMIONIC CORE CONFIGURATIONS OF THE CRITICAL ASSEMBLY ITR
M. Bloser, N. Kirch, F. J. Krings, N. Paul, and A. Naseband Jul. 1973 52 p refs In GERMAN; ENGLISH summary
(JUL-981-RG) Avail: AEC Depository Libraries HC $4.75

The physical properties of the ITR such as compactness, heterogeneity, and the new specific materials for the thermionic-zone required a critical experiment for checking the design calculations. Thermionic configurations and the mockup of the ITR are described. Experimental results are compared with actual available calculations of other authors. The results show that there are differences between experiment and calculation of kinetic parameters of small configurations, of reactivity values containing Wolfram components, and of power flattening. Monte Carlo methods and measuring techniques developed were successfully tested for reactivity disturbances introduced by the reflector even for complicated geometries. Author (NSA)

N74-19290# Flinders Univ., Bedford Park (Australia). School of Physical Sciences.
CONTROLLED FUSION RESEARCH Progress Report
M. H. Brennan Sep. 1973 21 p refs
(FUPH-G-4) Avail: AEC Depository Libraries HC $3.25

The current status of the international research program directed towards developing a fusion reactor for electricity production is assessed. Information is obtained mainly from meetings of the International Fusion Research Council (July 29 and Aug. 1, 1973) and the Sixth European Conference on Controlled Fusion and Plasma Physics held in Moscow from July 30 to August 3, 1973. The major items of business discussed at the meeting of the International Fusion Research Council are presented and the various national research programs are outlined. Finally, the Australian program is considered. NSA

N74-19291# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
SODIUM LOOP FOR REACTOR MATERIALS
V. Sulc [1973] 23 p refs in CZECHOSLOVAKIAN
(UJV-2232-R) Avail: AEC Depository Libraries HC $3.25

The effects of radiation on materials for fast reactors are described. Of the two types of loops that can be used in a materials testing thermal reactor, each has its advantages and disadvantages. Evaluation of the whole radiation program by study of the materials for a fast reactor helps solve the problem of the type of loop that should be constructed. In each case of constructing a sodium loop for a materials testing reactor, a group of workers should be formed to evaluate this problem. As an illustration, the BR-2 sodium loop at Mol is being studied by 22 workers with regard to theoretical and experimental reactor physics, measuring equipment, construction, testing, and other phases of the project. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N74-19292 Georgia Inst. of Tech., Atlanta.
AN EXPERIMENTAL STUDY OF NOISE PRODUCED BY OPEN TURBULENT FLAMES Ph.D. Thesis
Belur Narayana Shivashankara 1973 139 p
Avail: Univ. Microfilms Order No. 74-236

Noise generation from turbulent combustion zones is studied. The measurements are done in an anechoic chamber. Pilot flame stabilized turbulent flames at the end of burner tubes are employed. Propane, propylene and ethylene fuels are used air as the oxidizer. Combustion noise is shown to be weakly directional for both fuel-lean and fuel-rich flames. Comparison with Strahle's theory for fuel-lean flames shows that the refraction of sound at temperature discontinuities and the convection of sources by the flow are capable of qualitatively explaining the experimental directionality patterns. The spectra of the noise radiation indicate that combustion noise is broadband noise with a single peak. Over the entire range of parameters the noise from hydrocarbon-air flames is shown to peak in the 250-700 Hz range.
Dissert. Abstr.

N74-19293 Brigham Young Univ., Provo, Utah.
ELECTRICAL, MECHANICAL AND THERMAL PROPERTIES OF SINTERED DIAMOND PARTICLES Ph.D. Thesis
Richard L. Wheeler 1973 100 p
Avail: Univ. Microfilms Order No. 73-31210

The object of this research was to determine the causes of electrical conduction in a new form of polycrystalline (sintered) diamond, called Megadiamond. A model was postulated describing Megadiamond as interconnected spheres (1 to 5 microns) of electrically insulating diamond surrounded by a thin (0 to .05 micron) graphite film. To confirm the model, measurements were made of (1) resistivity, (2) temperature coefficient of resistivity, (3) Hall effect (negligible), (4) specific gravity (3.1-3.4), (5) composition by X-ray diffractometry (0 to 6.3 percent graphite), (6) thermal conductivity (2 to 4 watts/cm- C), and other related parameters. Other effects observed were increased hardness with electrical conductivity, electroluminescence, and an electron beam excited image storage. Dissert. Abstr.

N74-19294# Cambridge Univ. (England). Dept. of Engineering.
SPECTRAL BROADENING AND VARIABILITY OF DISCRETE TURBINE TONES PROPAGATING THROUGH UNSTEADY FLOW
J. M. Fitremann (Paris Univ.) and J. E. FfowcsWilliams [1973] 30 p refs
Avail: NTIS HC $4.50

Sound propagating through turbulence is subjected to both amplitude and phase modulation. Both cause an initially steady tone to be heard as a variable sound of broad bandwidth. These effects are consistent with observations made in routine tests of large jet engines. Four distinct sound distorting processes are identified. Physical arguments leading to their quantitative description are given. Sound is modified in transversing an

unsteady interface which is a possible modelling of both the jet shear layer and its unsteady shock cell boundaries. Author

N74-19295# Communications Research Centre, Ottawa (Ontario). Informatique Directorate.
THE COUPLING OF LIGHT FROM LIGHT-EMITTING DIODES INTO OPTICAL FIBERS: THE ANALYSIS OF CLOSE-COUPLING GEOMETRY
D. C. Johnson and B. S. Kawasaki Jan. 1974 30 p refs
(CRC-Rept-1250) Avail: NTIS HC $4.50

The efficiency of coupling light from a light-emitting diode (LED) into a fiber or fiber-optic bundle was determined using meridional ray and skew ray tracing techniques. Light loss due to Fresnel reflection was included in the efficiency calculations. The results indicate that the most important factor affecting the efficiency is the angular distribution of the light from the LED. It is shown that efficient coupling into a low numerical-aperture fiber requires the use of a lens or reflector to narrow the angular distrbution of the light from the LED. The results of the skew ray analysis indicate that the coupling efficiency is a function of the LED diameter. Author

N74-19296*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPTICAL ANALYSIS OF A COMPOUND QUASI-MICROSCOPE FOR PLANETARY LANDERS
Stephen D. Wall, Ernest E. Burcher, and Friedrich O. Huck Washington Apr. 1974 35 p refs
(NASA-TN-D-7414; L-9001) Avail: NTIS HC $3.25 CSCL 20F

A quasi-microscope concept, consisting of facsimile camera augmented with an auxiliary lens as a magnifier, was introduced and analyzed. The performance achievable with this concept was primarily limited by a trade-off between resolution and object field; this approach leads to a limiting resolution of 20 microns when used with the Viking lander camera (which has an angular resolution of 0.04 deg). An optical system is analyzed which includes a field lens between camera and auxiliary lens to overcome this limitation. It is found that this system, referred to as a compound quasi-microscope, can provide improved resolution (to about 2 microns) and a larger object field. However, this improvement is at the expense of increased complexity, special camera design requirements, and tighter tolerances on the distances between optical components. Author

N74-19297# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON FLUID DYNAMICS PANEL SPECIALISTS MEETING ON NOISE MECHANISMS
J. E. FfowcsWilliams Feb. 1974 19 p Meeting held at Brussels, 19-21 Sep. 1973
(AGARD-AR-66; AGARD-CP-131) Avail: NTIS HC $4.00

The mechanics of sound generation by turbulent flows was studied. The emphasis was on aeronautical problems arising from the field of aircraft noise control. Six separate headings which effectively categorize the subject areas of the papers presented are: (1) source identification; (2) the influence of mean flow structure on the generation and propagation of sound; (3) distinctive large eddy structures; (4) excess noise; (5) the control of jet noise; (6) problem areas likely to become more important. Author

N74-19298# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL STUDY OF THE CHARACTERISTICS OF ELECTRICAL DISCHARGE BETWEEN COAXIAL COPPER ELECTRODES IN A MAGNETIC FIELD
V. I. Alferov, O. N. Vitkovskaya, Yu. S. Ustinov, and G. I. Shcherbakov 18 Mar. 1974 6 p refs Transl. into ENGLISH from Teplofiz. Vys. Temp. (Moscow), v. 11, no. 6, 1973 p 1142-1146
(JPRS-61504) Avail: NTIS HC $4.00

Results of experimental investigations are presented for electrical discharge in the annular gap between cooled copper electrodes. Empirical formulas are presented for determination of discharge voltage and discharge velocity in an annular gap. Author

N74-19299# Ballistic Research Labs., Aberdeen Proving Ground, Md.
INTENSITY INTERFEROMETRY IN THE SPATIAL DOMAIN
Paul H. Deitz Nov. 1973 68 p refs
(DA Proj. 1M5-62603-A-286)
(AD-771135; BRL-1687) Avail: NTIS CSCL 20/6

A modification of the Hanbury Brown-Twiss experiment is described whereby intensity correlation is performed using coherent light and the statistical averages are taken in the space domain. This result is used to reconstruct the irradiance distribution of a spatially rough source. The far-field intensity distribution is recorded spatially for one time-resolution unit of the detector. The resulting spatial signal is autocorrelated and related to the intensity distribution over the source. Thus, without averaging in the time domain, a spatial Fourier-transform relation is derived between the far-field intensity correlation and the source irradiance, similar to the results of Hanbury Brown and Twiss. (Modified author abstract) GRA

N74-19300# Stanford Univ., Calif. Electronics Labs.
COMPUTER GENERATION OF COHERENT OPTICAL FILTERS WITH HIGH LIGHT EFFICIENCY AND LARGE DYNAMIC RANGE
Mate Severcan Dec. 1973 139 p refs
(Contract N00014-67-A-0112-0023)
(AD-771723; SU-SEL-73-049; SU-TR-6415-6) Avail: NTIS CSCL 20/6

Two new techniques for making computer generated spatial filters with high dynamic range and high light efficiency are described, and a general treatment of computer generated holograms is given. Examples of single-channel (continuous phase control) phase-only filters, binary phase-only filters, as well as the absorption-type filters have been realized experimentally. Experiments have been carried out for correcting blurred images and for character recognition. Finally, a ternary hologram (binary absorption and binary phase), which preserves advantages of both types of binary holograms but is capable of a higher dynamic range than either individually, has been realized experimentally using color film. (Modified author abstract) GRA

N74-19301# Army Foreign Science and Technology Center, Charlottesville, Va.
SPATIAL FILTERING IN OPTICAL DIRECTION-FINDING SYSTEM
V. L. Levshin 30 Oct. 1973 181 p refs Transl. into ENGLISH from Sovetskoe Radio (Moscow), 1971 199 p
(AD-771197/1GA; FSTC-HT-23-1070-73) Avail: NTIS HC $11.25 CSCL 17/3

Primary data processing is discussed in optical-electronic direction-finding systems for detecting a small object on a non-uniform random background. A theory is developed for moving image analyzers, and analysis is made of the characteristics of spatial filtering carried out by optical elements, and of scanning, modulating and photo-receiving devices of various kinds. Effects of parameters of emission sources and system elements on signal-to-noise ratio are studied. (Modified author abstract) GRA

N74-19302# Office of Naval Research, London (England).
ULTRASONICS INTERNATIONAL, 1973
Alfred E. Victor and Arthur H. Waynick 26 Jun. 1973 18 p refs
(AD-772707; ONRL-C-13-73) Avail: NTIS CSCL 20/1

A report is made on the meeting Ultrasonics International - 1973 held in London, England, March 27 - 29, 1973. The meeting covered current information on the latest developments and industrial applications in ultrasound research and technology. This including the topics of: high-power, metal forming, holography, physics, underwater transducers, surface waves, non-destructive testing and medical ultrasonics. Author (GRA)

N74-19303# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
APPLICATION OF THE BEAM DIFFUSION EQUATION FOR DESCRIBING LIGHT INTENSITY FLUCTUATIONS IN A RANDOMLY INHOMOGENEOUS MEDIUM
N. V. Zubareva 22 Aug. 1973 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Radiofiz. (Gorki), v. 16, no. 2, 1973 p 310-312

(Contract N00017-72-C-4401)
(AD-772730; APL-CLB-3-T-661) Avail: NTIS CSCL 20/6

It is shown that the beam cross-section remains constant when a light (electromagnetic) beam propagates through a medium having random inhomogeneities in its index of refraction, provided merely that certain mild statistical restrictions are required to be in force on the character of these vagaries in the medium, such as the need for uniformity and isotropy. Author (GRA)

N74-19304# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MUTUAL COHERENCE FUNCTION OF A BEAM PROPAGATING IN A TURBULENT MEDIUM
Ronald L. Fante 7 Sep. 1973 35 p refs
(AF Proj. 5635)
(AD-772659; AFCRL-TR-73-0566; AFCRL-PSRP-564) Avail: NTIS CSCL 20/6

Using transport theory the mutual coherence function of a beam propagating in a turbulent medium has been studied in detail, including the effect of the beam size, focal length and strength of the turbulence. The most detailed results are obtained for the MCF when the fluctuations have a Gaussian spectrum, but simple closed-form asymptotic results have also been obtained when the spectrum is a von Karman. Author (GRA)

N74-19305# Army Electronics Command, Fort Monmouth, N.J.
A SIMPLE METHOD FOR MEASURING ABSOLUTE DIFFUSE REFLECTANCE WITH A LABORATORY SPECTROPHOTOMETER
James D. Lindberg Nov. 1973 24 p refs
(AD-771216/9GA; ECOM-5521) Avail: NTIS HC $2.75 CSCL 20/6

A method is developed for measuring the absolute diffuse reflectance of the reference standard used in making relative diffuse reflectance measurements with an integrating sphere spectrophotometer. No extra experimental set up, such as a second integrating sphere, is required. The method is based on the Kubelka-Munk theory of diffuse reflectance. A graphical procedure is given, and an equation is derived which expresses the absolute reflectance as a function of four readily measurable quantities: two molar concentrations and two relative reflectances. (Modified author abstract) GRA

N74-19306# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
HETERODYNE DETECTION EXPERIMENTS AT 118.6 MICROMETERS AT Ge;Ga Report for Jan. 1972 - Jun. 1973
David H. Seib 23 Dec. 1973 16 p refs
(Contract F04701-73-C-0074)
(AD-772715; SAMSO-TR-73-399; TR-0074(4230-40)-4) Avail: NTIS CSCL 17/5

The observation and quantitative measurement of optical heterodyne detection in the far infrared (Lambda = 118.6 micrometers) using a Ge:Ga detector are reported. The experimental results fall below theoretical predictions; the discrepancy is explained in terms of the NEP of the detector used and the low value of local oscillator power available in the experiments. Author (GRA)

N74-19307# Marlow Industries, Inc., Garland, Tex.
MI 4010 THERMOELECTRIC MODULES
Porter B. Click, Jr. 18 Oct. 1973 22 p
(Contract DAAK02-73-C-0474)
(AD-771162/5GA) Avail: NTIS HC $2.75 CSCL 13/1

The report covers the design justification, physical specification and characterization of the MI 4010 module. The purpose of the contract was to demonstrate the capability to fabricate pieceparts, process into assemblies, and test thermoelectric modules equivalent to the module used in the hand held thermal viewer. The completed modules were also subjected to limited demonstration tests of reliability and useful life. GRA

N74-19308# Marlow Industries, Inc., Garland, Tex.
MI 6040 THERMOELECTRIC MODULES
Porter B. Click, Jr. 18 Oct. 1973 22 p
(Contract DAAK02-73-C-0474)
(AD-771163/3GA) Avail: NTIS HC $2.75 CSCL 13/1

The report covers the design justification, physical specification and characterization of the MI 6040 module. The purpose of the thermoelectric modules is the cooling of infrared detector arrays to temperature of 170K or colder. The completed modules were also subjected to limited demonstration tests of reliability and useful life. GRA

N74-19309# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A MULTIPLE SCATTERING RADIATIVE TRANSFER MODEL FOR USE IN GROUND TARGET SIGNATURE MODELING
Alan R. Downs, Kenneth E. Joel, and Philip W. Yunker Dec. 1973 60 p refs
(DA Proj. 1T1-61102-B-11A)
(AD-772915; BRL-MR-2346) Avail: NTIS CSCL 17/8

During FY 1972, the Army Materiel Command established a program to model predictively the signature of targets and backgrounds in the optical portion of the electromagnetic spectrum. One phase of this program addresses the reflective optical signature for natural sources of irradiation. This report describes one part of this effort, an attempt to predict the magnitudes of some of the relevant irradiation sources. The approach followed was to modify a previously developed single-scattering radiative transfer model to incorporate multiple scattering. The predictions from the revised model and an empirical model were then compared with extensive luminance measurements of the sun, sky, and a black panel for a wide variety of geometric and environmental conditions. A detailed discussion of the errors and their sources is included. Author (GRA)

N74-19127 Lockheed Missiles and Space Co., Sunnyvale, Calif.
EFFECTS OF CONFIGURATION AND EXCITATION ON SYSTEM LEVEL ACOUSTIC TESTING
W. J. Henricks *In its* Proc. of Aerospace Testing Seminar 1 Jun. 1973 10 p (For availability see N74-19120 10-15)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N74-19310* National Aeronautics and Space Administration, Washington, D.C.
DOPPLER SHIFT SYSTEM Patent
Sol Aisenberg, inventor (to NASA) (Space Sci., Inc., Waltham, Mass.) Issued 5 Mar. 1974 6 p Filed 28 Jun. 1972 Supersedes N72-28719 (10 - 19, p 2598) Sponsored by NASA
(NASA-Case-HQN-10740-1; US-Patent-3,795,448; US-Patent-Appl-SN-266943; US-Patent-Class-356-28; US-Patent-Class-356-106R; US-Patent-Class-356-112) Avail: US Patent Office CSCL 20H

A system is described for measuring velocities of radiating particles based on Doppler shift. Light from the particles is directed through a narrow band optical filter to a Fabry-Perot interferometer initially tuned to a selected center line corresponding to zero particle Doppler shift. The movable mirror of the interferometer is made to sweep about the center line by the output of a modulation oscillator. The fringe pattern output is imaged onto a pin hole through which light is directed to a photomultiplier. The output of the photomultiplier is supplied to a phase sensitive detector with the oscillator output as a reference signal and which operates in the quadrature mode. The detector's output is gain controlled and is combined with the oscillator's output to adjust the interferometer's movable mirror to acquire the line center. Official Gazette of the U.S. Patent Office

N74-19311+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THEORY OF A MAGNETOMETER FUNCTIONING WITH NUCLEAR PRECESSION [THEORIE DU FONCTIONNE-

MENT D'UN MAGNETOMETRE A PRECESSION NUCLEAIRE]
Daniel Bourdel Aug. 1972 32 p refs In FRENCH
(INPE-225-RI/026) Avail: NTIS HC $4.75

Block phenomenological equations are used to design and construct a proton precession magnetometer for solving the particular case of an already polarized sample placed in the terrestrial magnetic field. The order of magnitude of the signal and signal precession were determined. Data are also given on practical problems and conditions with respect to the good function of the magnetometer. Transl. by E.H.W.

N74-19312*# State Univ. of New York, Buffalo. Dept. of Physics and Astronomy.
OBSERVATION OF ELECTRON SPIN RESONANCE OF NEGATIVE IONS IN LIQUID HELIUM
Jonathan F. Reichert and Aronold J. Dahm (Case Western Reserve Univ.) [1973] 12 p refs
(Contract NCAw-33-183-005; AT(11-1)-2027; Grant NSF HO-39199)
(NASA-CR-137301) Avail: NTIS HC $4.00 CSCL 20H

Electron spin resonance signals of negative ions in liquid helium were observed. The line width and g-value were measured. Electrons injected into helium by field emission from ferromagnetic tips are shown to be polarized. A new technique for the measurement of electron spin polarization is presented. Author

N74-19313# Institute of Nuclear Physics, Krakow (Poland).
MOMENTS OF THE DENSITY-DENSITY CORRELATION FUNCTION OF LIQUID He-4
K. Parlinski Jan. 1973 37 p refs
(INP-822) Avail: AEC Depository Libraries HC $4.00

The zero, first, second, and third moments of the time dependent density-density correlation function for liquid He-4 at the ground state were calculated. The dual form of the first moment produces a condition which is equivalent to the BBGKY equation. Using the superposition approximation, the equation was solved, and the two particle distribution function was found. On its basis, the ground state energy was estimate to be -6.70 K (experiment -7.14 K). To calculate the second moment, the superposition approximation was employed.
Author (NSA)

N74-19314# Maryland Univ., College Park. Dept. of Physics and Astronomy.
COMPRESSIBILITY IN NUCLEAR COLLECTIVE DYNAMICS
James J. Griffin and Kit-Keung Kan Aug. 1973 15 p refs Sponsored by AEC
(ORO-4317-28; SM-174/58) Avail: NTIS HC $3.00

Because of the fact that the energy of nuclear matter increases very rapidly with changes in density, the nucleus as a fluid is generally assumed to be incompressible. It is proposed that this assumption is valid only on the average. It is shown that to impose it as a microscopic identity is inconsistent with a realistic description of finite nuclei, and precludes the consideration of certain phenomena which may play an essential role in collective dynamics. Author (NSA)

N74-19315# Oak Ridge National Lab., Tenn.
SELECTION OF GROUP ENERGY BOUNDARIES USING SENSITIVITY THEORY
E. Oblow, J. Ching, and J. Drischler 1973 3 p refs
(Conf-731101-12) Avail: NTIS HC $3.00

An attempt was made to use the sensitivity approach to develop an automated scheme for selecting multigroup energy boundaries so as to minimize the energy groups required to solve a specific problem. As a demonstration of the usefulness of the method, a series of problems involving transport in iron were studied. The general conclusion drawn from the results is that a few group problem dependent cross section sets are apparently practical; and if accurate sets with as few as ten groups are possible in other problem areas, it should be quite practical to choose a few hundred group boundaries for a multigroup library which will have guaranteed accuracy in calculating a fair number of widely different problems. NSA

N74-19316# International Centre for Theoretical Physics, Trieste (Italy).
STATIC FLUID SPHERES IN EINSTEIN-CARTAN THEORY
A. R. Prasanna Sep. 1973 19 p refs
(IC-73/120) Avail: AEC Depository Libraries HC $3.00

Using Trautman's formulation of Einstein-Cartan equations, a few solutions for static spheres composed of a perfect fluid of spinning particles were obtained. It was found that a space-time metric similar to Schwarzchild's interior solution will no longer represent a homogeneous fluid sphere. In the case of the solution where neutral proton/neutral rho meson yields 1/3 the condition that the spin is real sets in a natural restriction on the mass to radius ratio m/a. In these cases it was found that the metric potentials are not of class C1. Author (NSA)

N74-19317# Birmingham Univ. (England).
SURVEY OF KINETIC DATA ON ATOMIC AND FREE-RADICAL ADDITION REACTIONS Final Report
J. A. Kerr and M. J. Parsonage 1972 5 p refs
(OSTI-5122) Avail: British Library Lending Div., Boston Spa, Engl.

Gas phase addition reactions to alkenes, alkynes and aromatic compounds are considered. The particular atoms and radicals involved are H, halogen, nitrogen and group 6 atoms, especially sulphur and selenium, the alkyl radicals, halogenated radicals and a few less common species, such as the methanethiyl radical, CH3S, and the difluoroamino radical, NF2. For each reaction, thermochemical data have been calculated, rate constants and Arrhenius parameters listed with references and experimental details, and a preferred value for the parameters given with the reasons for the choice. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N74-19318 California Univ., Davis.
EXPERIMENTAL INVESTIGATION OF PLASMA TURBULENCE AND ANOMALOUS PLASMA RESISTIVITY RESULTING FROM PARAMETRIC INSTABILITIES Ph.D. Thesis
Arthur Lawrence Pavel 1973 129 p
Avail: Univ. Microfilms Order No. 73-32294

The coupling of electron plasma oscillations, ion acoustic waves, and an electromagnetic wave in a plasma is investigated. It was found that a finite electromagnetic wave can directly drive an electron plasma wave of its own frequency and spatial extent to many times the electric field size of the electromagnetic wave. The frequency spectrum of the parametric instability is measured and compared to computer plasma simulations. The evolution of this coupling into a turbulent plasma state, broad-banded in frequency with large electric fields for the electron plasma waves, is clearly shown. Gross physical changes can take place in a plasma as a result of these parametric instabilities. The most evident effect is the greatly enhanced absorption of electromagnetic energy by the plasma when the instability is excited. Strong plasma heating is the ultimate result of this coupling, with the resultant increase in the electron temperature and changes in the electron energy distribution. Dissert. Abstr.

N74-19319 Iowa State Univ. of Science and Technology, Ames.
ANALYTICAL APPLICATIONS OF INDUCTIVELY COUPLED PLASMA-OPTICAL EMISSION SPECTROSCOPY Ph.D. Thesis
Richard Newman Kniseley 1973 87 p
Avail: Univ. Microfilms Order No. 74-551

The applicability of an inductively coupled plasma-optical emission spectroscopic system to practical analytical problems is demonstrated using metallurgical samples and biological samples as typical examples. The evaluation is based on the ability of this excitation source to accurately determine trace and ultratrace concentrations of metallic elements in the presence of high concentrations of matrix materials which often are of variable composition. The results of the studies on whole blood and serum suggest that the inductively coupled plasma system

is capable of directly determining trace elements at the ng/ml level in biological fluids with essentially no sample preparation. The problems involved in the analysis of metallurgical samples are explored and the ability of the inductively coupled plasma excitation source to solve many of these problems is demonstrated. Dissert. Abstr.

N74-19320 California Univ., Irvine.
TURBULENT QUENCHING OF ELECTROSTATIC WAVES IN A Q-MACHINE PLASMA Ph.D. Thesis
Weldon Stoddard Williamson 1973 180 p
Avail: Univ. Microfilms Order No. 73-31429

The behavior of particles in a turbulent electric field may be described as a Brownian motion process in which the particle orbits are perturbed by scattering from turbulent fluctuations. Following the Dupree theory of plasma turbulence, the turbulent fields were treated as a stochastic part of otherwise coherent waves propagating in a magnetized, current-carrying, thermal plasma. These random fields produce a diffusive damping of the wave which may be characterized as a Markovian random walk of particles in velocity space, producing a diffusion process. For waves propagating across the magnetic field, the Dupree theory results in simple linear wave damping; the wave frequency acquires an imaginary part corresponding to the diffusive damping. For waves propagating along the magnetic field, the diffusive effects act in a different fashion, requiring a more complex analysis.
Dissert. Abstr.

N74-19321 Stevens Inst. of Tech., Hoboken, N.J.
NONLINEAR SATURATION OF CONVECTIVELY UNSTABLE BEAM-PLASMA INTERACTION Ph.D. Thesis
Derek Ashley Boyd 1973 107 p
Avail: Univ. Microfilms Order No. 74-862

The convectively unstable wave which occurs above the electron cyclotron frequency in beam-plasma systems in a magnetic field, has been studied experimentally. Measurements have been made on the velocity distribution function of the electron beam. Time averaged measurements, made at different axial positions show the trapped particles oscillating in the wave potential wells. Distributions obtained as a function of the phase of the wave, enable phase space plots of the beam distribution to be made. They show well developed trapped particle vortices in phase space and that a large fraction of the beam particles become untrapped after saturation. A system has been developed to measure the distribution of velocities perpendicular to the magnetic field. Measurements with this system show that the beam particles acquire very little perpendicular velocity in the interaction and that they continue to lose energy while the wave is damping. Dissert. Abstr.

N74-19322# Joint Publications Research Service, Arlington, Va.
PLASMA PROCESSES IN METALLURGY
B. Ye. Paton, ed. 26 Feb. 1974 193 p refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 20-37, 66-102, 110-122, 132-137, 143-151, 158-196, 207-230
(JPRS-61321) Avail: NTIS HC $12.75

State and development of the theory of generation and application of low temperature plasma are discussed including plasma arc heating. For individual titles, see N74-19323 through N74-19335.

N74-19323 Joint Publications Research Service, Arlington, Va.
PLASMA-ARC HEATING
A. V. Nikolayev *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 1-17 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 20-32 (For availability see N74-19322 10-25)

The energy indices of plasma arc heating in gaseous and condensed phases are discussed. Considered are heating by plasma produced by discharge, i.e. outside the electric field, and heating in the discharge itself under the conditions of an electric field.
Author

N74-19324 Joint Publications Research Service, Arlington, Va.
SEMI-SELF MAINTAINED ELECTRICAL DISCHARGE IN METAL VAPORS AND ITS APPLICATION IN THE PRODUCTION OF COATINGS AND CONDENSATES IN A VACUUM **c18**
M. Kh. Shorshorov, M. M. Nikitin, G. N. Klebanov, and A. N. Chadov *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 18-23 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 33-37 (For availability see N74-19322 10-25)

The application of semi-self supporting electrical discharge in metal vapors during production of coatings and condensates in a vacuum is examined. An electron beam plasma source is developed. When discharge is used the degree of ionization of the atoms that precipitate on the substrate increases significantly in comparison with the electron-beam heating method, reaching up to 30% for the investigated parameters. The energy of the vapor particles increases considerably as the result of excitation and ionization. The physico mechanical properties of the condensates and coatings and their strength of bond to the substrate are improved, which makes it possible to lower the substrate heating temperature required for activation of interaction processes. Author

N74-19325 Joint Publications Research Service, Arlington, Va.
THERMOPHYSICS OF PLASMA METAL SPRAYING, FACING, CUTTING AND SPHEROIDIZE ANNEALING
N. N. Rykalin, I. D. Kulagin, M. Kh. Shorshorov, V. V. Kudinov, Yu. L. Krasulin, V. A. Petrunichev, and A. A. Uglov *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 24-47 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 66-84 (For availability see N74-19322 10-25)

Thermal physics of plasma spraying, facing, cutting and spheroidize annealing processes indicate that linear theory of point heat sources may be used with results that are satisfactory for practical purposes, for describing phenomena that take place during an interaction of plasma with materials. However, aspects of the theory of the stated processes, including nonlinear phenomena, are sufficiently well developed. Among these aspects are problems of high temperature evaporation in a plasma jet, interactions of plasma with entrainment products, hydrodynamics of liquid phase during facing, liquid phase crystallization process, vaporization of multicomponent powders, among others. Author

N74-19326 Joint Publications Research Service, Arlington, Va.
AIR-PLASMA METAL CUTTING
K. Kh. Khrenov *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 48-53 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 84-88 (For availability see N74-19322 10-25)

The use of plasmatrons with zirconium tip copper cathodes for metal cutting processes are reported. For industrial utilization a tiny piece of zirconium wire is pressed into a copper ring, forming a replacable tip that is inserted into the electrode. Air plasma cutting produces a narrow heating zone and causes insignificant warping of the metal; productivity and quality of cutting depend on the cutting jet and its energy density. G.G.

N74-19327 Joint Publications Research Service, Arlington, Va.
STATE OF THE ART AND PROBLEMS OF PLASMA-ARC METAL CUTTING
K. V. Vasilyev *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 54-70 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 88-102 (For availability see N74-19322 10-25)

The efficiency of using oxygen mixtures as working plasma producing media for manual cutting machines is demonstrated. It is shown that the accuracy of plasma arc cutting is determined by: (1) The precision of transport of the axis of the cutting tool along a given contour; (2) absence of displacement of thermal deformations and other factors that occur during cutting; and (3) constant maintenance of the properties of the cutting arc and axis symmetric position relative to the plasmatron. G.G.

N74-19328 Joint Publications Research Service, Arlington, Va.
METALLURGICAL FEATURES OF PLASMA-ARC REMELTING OF HIGH-ALLOYED STEELS IN WATER-COOLED COPPER CRYSTALLIZER c17
B. Ye. Paton, V. I. Lakomskiy, G. F. Torkhov, and V. A. Slyshankova *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 71-88 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 71-88 (For availability see N74-19322 10-25)

Analysis of the dendritic structure of ball bearing steel produced by plasma arc remelting and of microliquation in it of its various elements revealed that processing in a water cooled copper crystallizer produced steel with high chemical homogeneity. G.G.

N74-19329 Joint Publications Research Service, Arlington, Va.
PRODUCTION OF MONOCRYSTALS OF HIGH-MELTING METALS BY PLASMA-ARC HEATING c26
Ye. M. Savitskiy, G. S. Burkhanov, N. N. Raskatov, and G. D. Shnyrev *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 89-95 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 132-137 (For availability see N74-19322 10-25)

Plasma heating was used to produce monocrystals of tungsten, molybdenum, rhenium and other high melting alloys, and for the purification of tungsten and molybdenum monocrystal through carbon removal. Tungsten monocrystals up to 50 mm in diameter and weighting more than 10 kg were grown by plasma arc in argon, helium hydrogen media or in their mixtures. G.G.

N74-19330 Joint Publications Research Service, Arlington, Va.
SOME PROBLEMS IN THE APPLICATION OF PLASMA HEAT SOURCES IN MODERN METALLURGY
M. Ya. Smelyanskiy and A. M. Kruchinin *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 96-106 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 143-151 (For availability see N74-19322 10-25)

Among the advantages of the electron-plasma furnaces over electron-beam melting installations are: (1) Higher operating pressure, which makes it possible to simplify and reduce the cost and size of the vacuum pumping system for the same gas flow rates in the furnace chamber; and (2) low operating voltage; (3) high operational stability of electron plasma furnaces in wide ranges of change of operating parameters: power, pressure, gas composition etc. Among the disadvantages of EPF are the need for pumping plasma producing gas through the plasma cathode. Author

N74-19331 Joint Publications Research Service, Arlington, Va.
SPRAY APPLICATION OF COATINGS c18
V. V. Kudinov *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 107-143 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 158-187 (For availability see N74-19322 10-25)

The theory of interaction materials during plasma spraying points the way to research that must be performed in order to solve the basic problems of the technology of this process. The role of structural and energy factors in a strong bond during formation of a coating is described here qualitatively and quantitatively. This makes it possible to examine both the technology and methods of plasma coating application from the same points of view. Author

N74-19332 Joint Publications Research Service, Arlington, Va.
FEATURES OF PHYSICO-CHEMICAL PROCESSES FOR PLASMA PRODUCTION OF COMPOSITION MATERIALS c18
N. N. Rykalin, M. Kh. Shorshorov, V. V. Kudinov, and Yu. A. Galkin *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 144-156 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 187-196 (For availability see N74-19322 10-25)

Plasma technology offers great possibilities in composite materials technology. Plasma methods can be used in almost all steps of composite material production, from manufacture of the initial products to the final finishing and protection of the finished product. The main advantage of plasma technology is the fact that it permits extremely accurate control of physico-chemical interaction of the materials of the matrix and fiber, limiting it to times of 0.1 to 0.0001 s; it also offers the possibility of achieving a firm bond between the fiber and matrix, based on the establishment of chemical bonds at the boundary between them. Author

N74-19333 Joint Publications Research Service, Arlington, Va.
LOW-TEMPERATURE PLASMA AND METAL REDUCING PROCESSES c17
Yu. V. Tsvetkov and S. A. Panfilov *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 157-167 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 207-214 (For availability see N74-19322 10-25)

The use of low temperasure plasmas as heat sources and chemically active media for metallurgical reducing technology is discussed. Processes - in which the electric current is supplied to the discharge zone through the material being processed - have high efficiency and provide relative operational reliability of the plasma discharge electron assembly; but their range of application is limited to only electrically conducting raw materials. Processes in which the material being processed is subjected to gas streams heated in the electric discharge zone produce pure metals and refined metal compounds; they are characterized by lower energy efficiency and greater technological complexity. G.G.

N74-19334 Joint Publications Research Service, Arlington, Va.
SYNTHESIS OF INORGANIC REFRACTORY COMPOUNDS c18
G. V. Samsonov *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 168-175 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 214-219 (For availability see N74-19322 10-25)

Low temperature plasmochemical processes are reported for producing refractory metal powder compounds as well as powders of the nitrides of boron and silicon, and also of nonmetallic aluminum nitride. G.G.

N74-19335 Joint Publications Research Service, Arlington, Va.
PRODUCTION OF SPHERICAL AND FINELY DISPERSED POWDERS IN LOW-TEMPERATURE PLASMA c18
N. N. Rykalin, V. A. Petrunichev, I. D. Kulagin, L. M. Sorokin, Ye. B. Koroleva, and A. B. Gugnyak *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 176-189 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 220-230 (For availability see N74-19322 10-25)

Low temperature plasma, generated in an arc or induction discharge, is an effective means of solving problems of producing refractory powders with spherical partical and ultradispersed powders with high specific area. The results of investigations using both arc and induction discharge plasma, are presented. At the present time it is still difficult to delineate the range of efficient utilization of these types of plasma heating. Author

N74-19336# Illinois Univ., Urbana. Aeronomy Lab.
THE IMPULSE RESPONSE OF A COLD STRATIFIED PLASMA IN THE PRESENCE OF COLLISIONS AND A VERTICAL MAGNETIC FIELD BY A MULTIPLE-SCATTERING TECHNIQUE
K. G. Gray and S. A. Bowhill [1973] 29 p refs Submitted for publication
(Grant NSF GA-36911X)
Avail: NTIS HC $4.50

The multiple scattering technique is extended to include the effects of simple collisions and a vertical magnetic field on the impulse response of a stratified cold plasma. In this case as in the free electron case it is possible to formulate a multiple scattering integral for the nth scattered field in terms of the (n-1)th scattered field. The total response is the sum over all orders of scatter. By an appropriate convolution process it is

possible to find the nth scattered field in the presence of collisions and a magnetic field from the corresponding scatter for the free electron case. This method is used to find the response of an infinite region of exponentially increasing electron density and a half space of uniform electron density in the presence of collisions and a magnetic field. Author

N74-19337# Illinois Univ., Urbana. Aeronomy Lab.
ELECTRON COLLISION FREQUENCIES AND ENERGY TRANSFER RATES
G. P. Mantas [1973] 30 p refs Submitted for publication (Grants NSF GA-25660; NSF GA-36911X)
Avail: NTIS HC $4.50

The rate of energy exchange, through elastic collisions, between two gases with Maxwellian velocity distributions at different temperatures, is derived from elementary considerations. This result is then used to calculate energy transfer rates and collision frequencies for energy transfer in plasmas at thermal disequilibrium. It is found that the electron/ion energy transfer rate and the collision frequency for energy transfer are overestimated by 5 percent to 37 percent, depending on the electron density and the electron and ion temperatures, when the classical Coulomb logarithm appears in these expressions. A more accurate cross section for Coulomb collisions (than that obtained when the shielded potential is truncated at the Debye length) leads to a correction term. Electron/electron and ion/ion collision frequencies and relaxation times differ from the usual expressions for these quantities by as much as a factor of two. Author

N74-19338*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CLOSED CYCLE MHD POWER GENERATION EXPERIMENTS IN THE NASA LEWIS FACILITY
Ronald J. Sovie and Lester D. Nichols 1974 9 p refs Presented at the 14th Symp. on Eng. Aspects of Magnetohydrodynamics, Tullahoma, Tenn., 8-10 Apr. 1974
(NASA-TM-X-71510) Avail: NTIS HC $4.00 CSCL 20I

Many modifications were made in the MHD facility. These include a redesign of the MHD duct interior, addition of mixing bars, increased electrical isolation of all the high temperature components from each other and from ground, and experimentation with various cesium seed vaporization and injection techniques. With the exception of the cesium system which needs further improvement the above modifications were quite successful and resulted in improvements in generator performance. The facility was run for a total of 400 hours in the past year, with 70 hours of this operation at temperatures of 2000 K or more with hot generator walls. With the exception of replacing one cracked brick in the MHD channel no repairs were required in the high temperature loop components for the duration of these tests. Uniform Faraday and Hall voltage profiles were obtained and the Faraday open circuit voltage varied from 90 to 100 percent of the ideal uBh. The magnitudes of the measured parameters are: Faraday open circuit voltage approximately 70 V, total Faraday current approximately 20 A, Hall voltage approximately 250 V, power output approximately 300 W, and power density .036 W/cu cm. Author

N74-19339# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANISOTROPY OF ELECTRON DISTRIBUTION FUNCTION OF AFTER-GLOW PLASMA GENERATED BY ELECTRON CYCLOTRON RESONANCE HEATING AND CONFINED IN MAGNETIC MIRROR FIELD
N. Yamamoto, H. Aikawa, Y. Hatta, and H. Ikegami Oct. 1973 19 p refs
(IPPJ-175) Avail: NTIS HC $4.00

Anisotropy of electron distribution function in after glow plasma generated by electron cyclotron resonance heating and confined in a magnetic mirror field is studied with the use of a magnetic mirror probe method. It is found that the observed distribution indicates the characteristics of the loss cone distribution function. Author

N74-19340# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A MODEL OF HIGH ENERGY TAIL FORMATION OF AN ION DISTRIBUTION IN TURBULENT PLASMA HEATING
Tadatsugu Hatori and Ryo Sugihara Oct. 1973 31 p refs
(IPPJ-176) Avail: NTIS HC $4.75

Ion heating by strong ion wave turbulence is theoretically considered. It is assumed that the electron temperature and the ion temperature are initially close so that the linear Landau damping of ion waves is fairly strong. It is also assumed that electron temperature increases in time in a way that a region of the resonant diffusion in velocity space gradually moves to higher velocity region, so that the resonant ions are accelerated for a relatively long time. An equation based on the above model is presented and is analytically solved. Under plausible assumptions we find the tail distribution is proportional to exp(-v/u sub o)where u sub o is the trapping velocity defined by Dupree. Author

N74-19341# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ON THE ELECTRON TEMPERATURE DETERMINATION OF A RELATIVISTIC PLASMA BY LASER SCATTERING
Kiyoshi Hayase and Takayoshi Okuda Oct. 1973 21 p refs
(IPPJ-178) Avail: NTIS HC $4.25

The relativistic formula of laser scattering from a plasma is derived. The spectra of the scattered light are calculated as functions of the electron temperature and the scattering angle. The spectrum deviates considerably from the Gaussian profile when the temperature is high. The relativistic effect must be taken into account in the temperature determination at the temperature higher than a few hundred eV, otherwise the temperature is overestimated in the blue side of the spectrum. Methods are presented for obtaining a correct temperature in a relativistic plasma. Author

N74-19342# Nagoya Univ. (Japan). Inst. of Plasma Physics.
OBSERVATION OF STATIONARY SHOCK-LIKE STRUCTURE AND FNHANCED DIFFUSION IN A TOROIDAL PLASMA
A. Mohri and M. Fujiwara Nov. 1973 30 p refs
(IPPJ-179) Avail: NTIS HC $4.50

Electrons are injected into an afterglow plasma confined in a l = 3 stellarator to raise the poloidal rotational velocity. A steady shock-like structure characterized by a steep density gradient is observed near a critical rotational speed. A strong enhancement of diffusion rate occurs at higher radial electric field, accompanying with large amplitude density fluctuations. Vortices are generated at three corners of the triangular magnetic surfaces when the radial electric field turns over going to the periphery. Author

N74-19343# Nagoya Univ. (Japan). Inst. of Plasma Physics.
FREE BOUNDARY MHD EQUILIBRIA IN AXISYMMETRIC TORI
Y. Suzuki Dec. 1973 34 p refs
(IPPJ-180) Avail: NTIS HC $4.75

A method of numerical computation is presented to obtain the equilibrium configurations in axisymmetric tori with the ideally conductive shells of arbitrary cross sections and/or with control field coils. An artificial function is introduced which makes it possible to combine the equilibrium equations in the plasma and the equation for the vacuum into one equation. The alternating direction implicit method coupled with the Marder-Weitzner iteration scheme is used to solve the combined equilibrium equation under the boundary condition given on the shell. The continuity conditions at the plasma-vacuum interface are satisfied automatically in the obtained solutions. Some results of the computation are illustrated. Author

N74-19344# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THEORY OF THE ADIABATIC RF PLUGGING IN THE MAGNETIC CUSP FIELD
T. Hatori and T. Watanabe Feb. 1974 40 p refs
(IPPJ-182) Avail: NTIS HC $5.00

The necessary and sufficient condition is obtained for describing the guiding center motion of a particle by the quasi-potential. This analysis leads to a new concept of the critical energy, the height of the adiabatic barrier, which is proportional to E sub 0 to the 8/5th power, E sub 0 being the strength of the rf electric field in the plasma. The theoretical results are confirmed by numerical calculations. Author

N74-19345# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DENSE RELATIVISTIC ELECTRON PLASMA BY ELECTRON CYCLOTRON HEATING AND ADIABATIC COMPRESSION

Hiroshi Aikawa, Shigeru Okamura, Minoru Hosokawa, Shuko Aihara, Igor Alexeff (Tenn. Univ.), and Hideo Ikegami Jan. 1974 21 p refs
(IPPJ-183) Avail: NTIS HC $4.25

The hot-electron plasma produced by resonant electron cyclotron heating was successfully used as a well-controlled initial phase for a subsequent slow compression experiment. The plasma electron temperature increased almost linearally with an increase of magnetic field up to a compression ratio of over 10:1. The initial value was about 10 keV, and the final value was about 110 keV. An important observation was that the compressed plasma appeared to be stable, even when the cold background plasma density decreased dramatically. Author

N74-19346# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
RELATIVISTIC DENSITY MATRIX IN PHASE SPACE
D. I. Blokhintsev 1973 14 p In RUSSIAN
(JINR-P2-7424) Avail: AEC Depository Libraries HC $3.00

An equation is obtained for relativistic plasma oscillations taking into account the particle spin. Author (NSA)

N74-19347# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.
SYNCHROTRON RADIATION SPECTRUM NEAR THE ELECTRON CYCLOTRON FREQUENCY AND ITS FIRST HARMONIC, DEDUCTION OF THE ELECTRON DISTRIBUTION FUNCTION
J. Jacquinot, J. P. Poffe, and J. Waldes 1973 4 p refs Presented at the 11th Intern. Conf. on Phenomena in Ionized Gases, Prague, 10-16 Sep. 1973
(CEA-CONF-2386; Conf-730906-12) Avail: AEC Depository Libraries HC $3.00

A hot tenuous plasma confined in a fairly homogeneous field is considered. In such a plasma synchrotron radiation is composed of well-defined lines emitted at frequencies slightly below the cyclotron frequency of an electron at rest. The radiation emitted, in the extraordinary mode, in a direction perpendicular to the magnetic induction is discussed. The dominant broadening process of the lines comes from the relativistic change of mass. However, nonuniformity of the magnetic field and Doppler shifts may produce small parasitic-broadening effects. The weak normalized density and the high electron temperature reduce to a negligible level the broadening effects produced by the other possible mechanisms (radiation and collisional broadening, self-adsorption, and plasma dispersion effects). NSA

N74-19348# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. of Physique du Plasma et de la Fusion Controlee.
MIXING OF ELECTROSTATIC WAVES IN A RADIALLY INHOMOGENEOUS HOT ELECTRON PLASMA
F. Gervais, M. Guillemot, and A. Quemeneur 1973 4 p refs Presented at the 11th Intern. Conf. on Phenomena in Ionized gases, Prague, 10-16 Sep. 1973
(CEA-CONF-2384; Conf-730906-10) Avail: AEC Depository Libraries HC $3.00

Three-wave interaction was studied earlier for an infinite electron plasma or for the propagation in a circular waveguide filled with an homogeneous plasma. To fit with experimental results, it is necessary to take into account the radial decay of the density. A hot plasma radially limited by a cylindrical waveguide of radius R and immersed in a strong magnetic field is considered. The propagation of electron Langmuir waves is considered in particular. NSA

N74-19349# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fussion Controlee.
CORRELATION BETWEEN THE NATURE OF VELOCITY-SPACE ANISOTROPY AND THE FREQUENCY OF ELECTROSTATIC ELECTRON-CYCLOTRON INSTABILITIES
J. Jacquinot, C. Leloup, R. Pellat, M. Abdalla, and G. Chanteur 1973 4 p refs Presented at the 11th Intern. Conf. on Phenomena in Ionized Gases, Prague, 10-16 Sep. 1973
(CEA-CONF-2385; Conf-730906-11) Avail: AEC Depository Libraries HC $3.00

Both laboratory and outer space plasmas exhibit a great variety of unstable cyclotron modes usually characterized by a well-defined frequency domain. It is shown that it is possible, in most cases, to infer qualitative information on the anisotropy of the distribution function by the simple knowledge of the frequency spectrum of the anomalous radiation emitted by the plasma. The characteristics of known instabilities are reviewed, then an instability requiring a positive df/dE at low energy (loss cone) and a small amount of cold plasma are discussed. NSA

N74-19350# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
LINEAR RF TURBULENT HEATING EXPERIMENT
H. M. Skarsgard Jun. 1973 19 p refs
(LRP-64/73) Avail: AEC Depository Libraries HC $3.00

Changing the RF experiment to try to produce hot, turbulent plasmas and also the feasibility of investigating the turbulence using the (CO2) laser scattering technique is discussed. Author (NSA)

N74-19351# Oxford Univ. (England). Dept. of Engineering Science.
SOME EXPERIMENTS WITH A THERMALLY PRODUCED CESIUM PLASMA Progress Report, Jan. - Sep. 1970
A. D. R. Phelps and J. E. Allen 1973 55 p refs Sponsored in part by Sci. Res. Council
(Rept-1075/73) Avail: NTIS HC $5.75

Plasma density measurements do not agree with the simplest theoretical predictions based on the control of the cesium vapor pressure. A floating sheath theory is discussed which predicts an experimental variation of plasma density with cavity temperature. Other experimental evidence relating to cesium distribution in the apparatus is used to assess the relevance of the floating sheath theory. As a result of the improved power stabilization of the outer vacuum diode, a greater range of cavity temperature is obtainable. This development was exploited in temperature dependence measurement of constant frequency oscillation. The frequency of the largest amplitude component of the spectrum under normal conditions is found to increase with temperature. The importance of the finite sheath thickness and its strong dependence on the cavity temperature (via the plasma density) is underlined. The effect of applying an axial magnetic field on the cesium plasma is also reported. Author (ESRO)

N74-19352# Humphreys Corp., Bow, N.H. TAFA Div.
STUDY OF HIGH POWERED PLASMA FOR IN SITU HARD ROCK DISINTEGRATION Final Technical Report, 1 Apr. 1972 - 21 Jul. 1973
John W. Poole and Merle L. Thorpe 21 Jul. 1973 84 p refs
(Contract DI-BM-HO-220051; ARPA Order 1579)
(AD-772506; TAFA-7311-9) Avail: NTIS CSCL 13/2

The report describes an investigation of hard rock cutting using a transferred arc plasma for melting narrow, deep cuts in hard rock at high speed and removing the intervening rock by thermal fracturing. The one year experimental program resulted in the development of a cutting system capable of operating horizontally and vertically at 250-500 kW, producing continuous cuts in granite and basalt at 2-1/2 to 12 inches per minute depending on cut depth which ranged from one to nineteen inches. Thermal melting efficiencies were in the range of 20-30 percent. (Modified author abstract) GRA

N74-19353# Mission Research Corp., Santa Barbara, Calif.
LINE RADIATION FROM A PLASMA WITH ENERGY TRANSFER BETWEEN IONS AND ELECTRONS VIA COULOMB SCATTERING, VOLUME 1 Final Report, 1 May 1972 - 30 Sep. 1973
Robert N. Wilson 27 Nov. 1973 75 p refs
(Contract DNA001-72-C-0145)
(AD-772538; MRC-R-53-Vol-1; DNA-3184F-1) Avail: NTIS CSCL 07/4

The problem of steady-state non-local thermodynamic-equilibrium line-radiation transport is formulated for a plasma consisting of two-level ions and electrons. The treatment allows energy transfer between the translational degrees of freedom of the ions and the radiation field. Energy transfer mechanisms are discussed. The system of coupled rate equations and radiation transport equation is solved by linearizing the rate equations in

electron temperature and solving the radiation transport equation in Eddington approximation. The authors present analytic results for the effective volume emission rate due to radiated energy, and they also present numerical results for the variation of electron temperature and the level populations with position in the plasma, along with some qualitative arguments supporting the theory presented. (Modified author abstract) GRA

N74-19354# Mission Research Corp., Santa Barbara, Calif.
LINE RADIATION FROM A PLASMA WITH ENERGY TRANSFER BETWEEN IONS AND ELECTRONS VIA COULOMB SCATTERING, VOLUME 2 Final Report, 1 May 1972 - 30 Sep. 1973
Robert N. Wilson 27 Nov. 1973 57 p refs
(Contract DNA001-72-C-0145; DNA Proj. NWED-QAXH)
(AD-772542; MRC-R-60; DNA-3184F-2) Avail: NTIS CSCL 07/4

The authors formulate and solve the steady state problem of non-local thermodynamic-equilibrium line-radiation transport for a plasma consisting of two-level ions and electrons. The treatment allows energy transfer between an infinite energy (temperature) reservoir and the radiation field. The energy transfer mechanisms are discussed. The system of coupled rate equations and radiation transport equation is solved by linearizing the rate equations and radiation transport equation in the deviations of the electron temperature and ion kinetic temperature from their values in the central portion of the slab. The resulting system of equations is solved in the low temperature approximation in first Eddington approximation. The authors present results for the fractional energy loss of radiated energy. (Modified author abstract) GRA

N74-19355# Naval Research Lab., Washington, D.C.
PARAMETRIC INSTABILITIES INDUCED BY THE COUPLING OF HIGH AND LOW FREQUENCY PLASMA MODES
Wallace M. Manheimer and Edward Ott Dec. 1973 40 p refs
(NRL Proj. H02-29)
(AD-772533; NRL-MR-2685) Avail: NTIS CSCL 20/9

A general dispersion relation is derived for parametric instabilities caused by a large amplitude pump wave which couples high and low frequency modes of a magnetized plasma. The nonlinear effects coupling the high and low frequency waves are: (1) the low-frequency pondermotive force due to the coupling of the pump with the high frequency perturbations, and (2) the high frequency nonlinear source current density produced by coupling of the pump with the low frequency perturbations. The dispersion relation contains decay instabilities, purely growing instabilities, modulational instabilities, self-focusing and nonlinear Landau damping. As examples the authors apply the dispersion relation to self-focusing, magnetosonic decay and purely growing instabilities, whistler decay and nonlinear Landau damping of electron plasma waves and transverse electromagnetic waves.
Author (GRA)

N74-19356# Naval Research Lab., Washington, D.C.
THE FLYING CUSP: A COMPACT PULSED FUSION SYSTEM
Anthony E. Robson Dec. 1973 27 p refs
(NRL Proj. H02-28; RR01109)
(AD-772532; NRL-MR-2692) Avail: NTIS CSCL 20/9

A dynamic plasma compression system is proposed in which imploding liner techniques of megagauss field generation are combined with plasma containment in cusp geometry. A one-dimensional, thin-liner model is developed in which plasma losses are included self-consistently. Scaling laws are derived for a fusion feasibility experiment based on this principle.
Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N74-19357 California Univ., Irvine.
STUDIES OF SEMICONDUCTORS AND SUPERCONDUCTORS BY SURFACE REFLECTION RAMAN SCATTERING Ph.D. Thesis
David Jones Evans 1973 216 p
Avail: Univ. Microfilms Order No. 73-31442

By means of surface reflection Raman scattering the dependence of the q = 0 TO and LO phonon line shapes in GaAs on surface preparation were investigated. Polished surfaces have broad phonon lines compared to etched, annealed, or cleaved surfaces. Microscopic disorder can broaden phonon lines in at least two ways. Line broadening may occur because of increased phonon anharmonic decay in polished surfaces caused by lowering of lattice symmetry in damaged surface layers. Phonon lines may also broaden by inhomogeneous strain shifting of the phonon frequency to higher and lower values. The temperature dependence of phonon lines in polished and annealed surfaces was studied, and it was observed that the difference in phonon linewidths for these two surfaces is indepedent of temperature. It was concluded that phonon lines are broadened by inhomogeneous strain, since increased anharmonic decay depends explicitly on temperature. Dissert. Abstr.

N74-19358 California Univ., Davis.
TIME DEPENDENT NUMERICAL ANALYSIS OF METAL-OXIDE SEMICONDUCTOR DEVICES Ph.D. Thesis
Thomas William Collins 1973 256 p
Avail: Univ. Microfilms Order No. 73-32265

The dynamic properties of a metal-oxide-semiconductor structure are simulated using numerical techniques. The time-dependent behavior of the electrons and holes is obtained for both the large signal transient and small signal sinusoidal applications in the presence of deep lying Shockley-Reed-Hall recombination centers. The computational is performed throughout the entire device including both the insulator and semiconductor materials. The results point out the deficiencies in the existing metal-oxide-semiconductor capacitance theories and offer alternative explanations. A new model, based on lumped parameters, which explains the minority carrier charging current for the thin substrate device is developed. Dissert. Abstr.

N74-19359 Stevens Inst. of Tech., Hoboken, N.J.
SIMULATION OF ELECTRON TRANSMISSION IMAGES OF CRYSTALS CONTAINING RANDOM AND ORDERED ARRAYS OF COHERENCY STRAIN CENTERS Ph.D. Thesis
Peter J. Fillingham 1973 158 p
Avail: Univ. Microfilms Order No. 74-876

The nature of the ordering of defect clusters into two and three dimensional arrays is dealt with by the simulation of electron transmission images of crystals containing random and ordered arrays of coherency strain centers. It is concluded that the most probable arrangement of such defects lies between complete randomness and structures containing variants of a two-dimensional ordered configuration. The applicability of these results to several different alloy systems is disucssed.
Dissert. Abstr.

N74-19360 Auburn Univ., Ala.
KINETICS OF OXIDE FILM GROWTH ON METAL CRYSTALS: SPACE-CHARGE-MODIFIED THERMAL ELECTRON EMISSION AND IONIC DIFFUSION Ph.D. Thesis
Ronald Bruce Mosley 1973 302 p
Avail: Univ. Microfilms Order No. 74-123

A complete coupled-currents numerical calculation for metal oxidation is presented which is based on ionic diffusion and thermal electron emission in the presence of space charge of the diffusing ionic species. The presently-deduced spacecharge-modified kinetics illustrate the following: (1) In the early growth stage, the negative surface-charge field is an order of magnitude larger than its homogeneous field counterpart; this significantly aids the injection of rate-limiting electronic carriers into the conduction band of the oxide, and the oxide growth rate is thereby enhanced. (2) In the later stages of growth where the ionic species become rate-limiting, the space charge of the diffusing ions causes a marked retardation of the ionic current and the accompanying oxide film growth. (3) The transition

from electronic rate-limited growth to ionic rate-limited growth occurs shortly after the classical electron energy barrier maximum switches from inside the film. Dissert. Abstr.

N74-19361 St. Johns Univ., Jamaica, N.Y.
STUDY OF WEAKLY-LINKED BULK SUPERCONDUCTORS Ph.D. Thesis
Anand Murari Saxena 1973 127 p
Avail: Univ. Microfilms Order No. 73-29975

An investigation of some of the properties of aluminum particles of microscopic size prepared by evaporation technique has been made at low temperatures, near and below superconducting transition temperature. The susceptibility measurements on aluminum particles having dimensions much smaller than the G-L coherence length were made in uncompacted state using a tunnel diode oscillator. When the transition temperature is approached from the low temperature side, the observed susceptibility increases approaching the normal state value at a faster rate than predicted by London's or Schmidt's theories. This anomaly is explained by assuming that the particles fluctuate to the normal state when their condensation energy is comparable to thermal activation energy, kT. The number of particles fluctuating to the normal state is determined by the Boltzmann factor. Dissert. Abstr.

N74-19362 California Univ., Los Angeles.
DETERMINATION OF THE CONDUCTION BAND EFFECTIVE MASS OF THE GERMANIUM-SILICON ALLOY BY INFRARED CYCLOTRON RESONANCE Ph.D. Thesis
David Fink 1973 263 p
Avail: Univ. Microfilms Order No. 74-1563

Cyclotron resonance has been performed on the conduction band of the germanium-silicon alloy at 891 GHz using an infrared laser. This has enabled measurement of the longitudinal and transverse effective masses to within 4 atomic per cent of each side of the alloy composition (15 atomic per cent Si in Ge) at which the conduction band minimum changes from a Ge-like minimum to a Si-like minimum. The masses do not appear to change from their values in the pure materials, although only the transverse mass of the Ge-like minimum was measured with good accuracy. Dissert. Abstr.

N74-19363 University of Southern Calif., Los Angeles.
PHOTOINJECTION AT METAL-SEMICONDUCTOR INTERFACES Ph.D. Thesis
Carl Lawrence Anderson 1973 242 p
Avail: Univ. Microfilms Order No. 73-31320

A study was undertaken to investigate both theoretically and experimentally the effects of thermal excitation, quantum-mechanical reflection, and optical phonon scattering on the process of photoinjection at metal-semiconductor interfaces. The material presented is significant to the understanding of current transport in metal-semiconductor devices and to the understanding of the electrostatic phenomena which determine the Schottky barrier height. Under conditions of moderate doping and temperature, photoinjection at metal-semiconductor interfaces should be treated as a process of photo-assisted thermionic-field emission. A generalized theory of the photoresponse of metal-semiconductor (Schottky) barriers based on this approach was developed. This treatment is applicable to both direct- and indirect-gap materials at finite temperatures under conditions of nonclassical transmission of electrons. Dissert. Abstr.

N74-19364 Post Office Research Dept., London (England).
REFLECTION X-RAY TOPOGRAPHY OF SEMICONDUCTORS. PART 2: COMPARISON OF SIX SEMICONDUCTOR MATERIALS
M. A. G. Halliwell and J. B. Childs 8 Jan. 1973 14 p refs (Rept-343) Copyright. Avail: Issuing Activity

The X-ray topography of semiconductor materials is described. Topographs of silicon, gallium phosphide, gallium arsenide, and indium phosphide are shown together with theoretical data required to choose the optimum reflection conditions for these materials, and for germanium and indium antimonide. All these materials are of potential interest to the Post Office, mainly for the microwave device program. Increasingly, devices and circuits for all purposes are fabricated in a thin epitaxial layer on one surface of a much thicker semiconductor slice which serves as a substrate. In this situation the established transmission topography provides information dominated by the substrate, whereas reflection topography from the epitaxial layer provides the information most relevant to the device programe. Author

N74-19365 Vanderbilt Univ., Nashville, Tenn.
THE EFFECTS OF ASYMMETRICAL VARIATIONS OF THE STATIC MAGNETIZATION ON THE SPIN-WAVE SPECTRA OF MAGNETIC THIN FILMS Ph.D. Thesis
Raymond Earl Dodd 1973 122 p
Avail: Univ. Microfilms Order No. 74-1338

The effects of asymmetrical spatial variations of the static magnetization on the spin-wave spectra of conducting (Permalloy) films and insulating (yttrium iron garnet) films for different spin pinning conditions are considered. Theoretical spectra of selected Permalloy and yttrium iron garnet (YIG) films were obtained numerically by solving the equation of magnetization for the case of perpendicular resonance (static magnetic field normal to the plane of the film). The numerical solution, which was accomplished by use of a system of difference equations and matrix techniques, was based on the assumptions: (1) the static magnetization across the film was spatially dependent, (2) the variation of magnetization was asymmetrical, and (3) the effects of damping were neglected. Comparisons of the theoretical spectra and experimental spectra were made, and it was found that the theoretical spectra provide a good fit of the experimental values. Dissert. Abstr.

N74-19366 Stevens Inst. of Tech., Hoboken, N.J.
AN INVESTIGATION OF THE SNS JOSEPHSON JUNCTION AS A THREE-TERMINAL DEVICE Ph.D. Thesis
George Paul Prans 1973 149 p
Avail: Univ. Microfilms Order No. 74-889

The effect of the control current on the junction current was described by an empirical parameter. The resulting transistor-like output current-voltage characteristics support the findings of Rockefeller. The value of an empirical parameter was typically 0.8, and it was discovered to depend upon resistance ratio of the two halves of the N layer. In particular, an empirical parameter could be varied by introducing a thin oxide layer at one of the SN interfaces. A low frequency, lumped, nonlinear model was proposed to describe the electrical characteristics of the device. The three-terminal current-voltage characteristics were in good agreement with those predicted by the model. A method peculiar to the three-terminal device was developed to plot the dynamic junction resistance as a function of junction current.
Dissert. Abstr.

N74-19367 Stevens Inst. of Tech., Hoboken, N.J.
DETERMINATION OF THE VELOCITY-FIELD CHARACTERISTIC OF GALLIUM ARSENIDE FROM HIGH-FIELD DOMAIN MEASUREMENTS Ph.D. Thesis
Vasilis Emmanuel Riginos 1973 204 p
Avail: Univ. Microfilms Order No. 74-891

A method was developed for measuring average electron drift velocity as a function of the electric field for semiconductor materials which exhibit bulk negative differential conductance. The characteristic is determined from measurements made on high field Gunn effect domains. The method was applied to the velocity-field characteristic measurement of GaAs. This curve correlates well with the velocity-field characteristic theoretically calculated by Heinle. The domains in the GaAs samples were measured by a resistive and a capacitive probe. The latter was constructed by a vacuum deposition technique. Dissert. Abstr.

N74-19368# Kentucky Univ., Lexington. Dept. of Metallurgical Engineering and Materials Science.
GRAIN BOUNDARY MOBILITY IN ANION DOPED MgO
Cawas M. Kapadia and Martin H. Leipold [1972] 53 p refs
Avail: NTIS HC $5.75

Certain anions (OH(-) F(-) and CL(-)) are shown to enhance grain growth in MgO. The magnitude of their effect decreases in the order in which the anions are listed and depends on their locatic (solid-solution, second phase) in the MgO lattice. As most anions exhibit relatively high vapor pressures at sintering temperatures, they retard densification and invariably promote residual porosity. The role of anions on grain growth rates was studied in relation to their effect on pore mobility and pore

removal; the atomic process controlling the actual rates was determined from observed kinetics in conjunction with the microstructural features. With respect to controlling mechanisms, the effects of all anions are not the same. OH(-) and F(-) control behavior through creation of a defect structure and a grain boundary liquid phase while CL(-) promotes matter transport within pores by evaporation-condensation. Studies on an additional anion, S2(-) gave results which were no different from undoped MgO, possibly because of evaporative losses during hot pressing. Hence, the effect of sulphur is negligible or undetermined. Author

N74-19369*# Alfred Univ., N.Y. Coll. of Ceramics.
A METHOD FOR DETERMINING THE PREFERRED ORIENTATION OF CRYSTALLITES NORMAL TO A SURFACE
Robert L. Snyder and William L. Carr 1973 19 p refs
(Contract NCAW-33-187-002)
(NASA-CR-137229) Avail: NTIS HC $4.00 CSCL 20B

Techniques representing the angular distribution of a particular direction in a crystallographic reference frame or analytical methods were developed. The data required by these techniques for displaying preferred orientation is obtained by measuring the orientation of a large number of crystallites. This may be done visually using etch-pit or Laue techniques which, experimentally, are both tedious and difficult. The intensities of X ray diffraction maxima are proportional to the number of crystallites whose crystallographic plane normals bisect the incident and diffracted beams. Parameters used in calculating powder patterns are also presented. Author

N74-19370*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERNAL FRICTION MEASUREMENT IN HIGH PURITY TUNGSTEN SINGLE CRYSTAL
Georges E. Rieu Feb. 1974 18 p refs
(NASA-TM-X-71506; E-7882) Avail: NTIS HC $4.00 CSCL 20B

Internal friction peaks observed after small deformation in high purity tungsten single crystals between liquid helium temperature and 800 K in the frequency range 30-50 KHz, are studied as a function of orientation. An orientation effect is observed in the internal friction spectra due to the creation of internal stresses. The elementary processes related to these peaks are discussed in terms of kink generation and geometric kink motion on screw and edge dislocations in an internal stress field. Author

N74-19371*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERNAL FRICTION PEAKS OBSERVED IN EXPLOSIVELY DEFORMED POLYCRYSTALLINE Mo, Nb, AND Cu
G. E. Rieu, H. H. Grimes, J. F. Romain, and J. DeFouquet Jan. 1974 11 p refs
(NASA-TM-X-71507; E-7918) Avail: NTIS HC $4.00 CSCL 20B

Explosive deformation (50 kbar range) induced, in Cu, Mo and Nb, internal friction peaks identical to those observed after large normal deformation. The variation of the peaks with pressure for Mo and Nb lead to an explanation of these processes in terms of double kink generation in screw and edge dislocations. Author

N74-19372# Lyon Univ. (France).
PHOTOCURRENTS INDUCED BY A RADIATION IMPULSE IN SEMICONDUCTOR DEVICES Ph.D. Thesis
R. Gaillard 1973 85 p refs In FRENCH
(LYCEN-7322) Avail: AEC Depository Libraries HC $6.25

The fundamental mechanisms involved in the transient effects induced in semiconductors by radiation were studied in view of hardening of electronic systems. The following techniques for electrically testing and stimulating transient effects are described: neodymium switched lasers, GaAs diode lasers, proton pulses from pulsed Van de Graaff machines, electron pulses from a Bevatron, and pulses from gamma-ray generators. The primary photocurrent from the base-collector junction is an important parameter. Calculation methods were developed for low levels of generation (small dose rates). The application of relations obtained for the primary photocurrents to calculations of the overall response of bipolar transistors (secondary photocurrents, storage time when exposed to radiations) is envisaged, the way in which the photocurrents can be included in the large signal models used in the CAO programs for analyzing the circuits being described. The problem of anomalous photocurrents in epitaxial devices was also studied. NSA

N74-19373# Oak Ridge National Lab., Tenn.
CRYOGENIC DIELECTRICS AND SUPERCONDUCTING AND CRYOGENIC MATERIALS TECHNOLOGY FOR POWER TRANSMISSION Annual Report, 1 Jul. 1973
Nov. 1973 150 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4341) Avail: NTIS HC $9.50

The principal effort in the dielectric program during this reporting period, March 1 to June 20, has been to install the 700 kV series resonant transformer so that high voltage ac testing can be accomplished. Provisions were made that this unit will share a test stand with the Haefely 600 kV dc power supply. Design and fabrication of a helium dewar with a 1000 kV bushing for use in this test stand has continued. The design of a cryostat for experiments with intermediate voltages was completed, and the assembling of this cryostat is under way. A small laboratory exploratory experiments with voltages up to 130 kV dc and 80 kV ac has been set up. A Biddle partial discharge detector has been ordered. A Faraday cage has been located which can provide a low interference laboratory for low level discharge measurements. Auxiliary investigations have been continued which are necessary for the design, construction, and operation of test equipment. Author (NSA)

N74-19374# Oak Ridge National Lab., Tenn. Thermonuclear Div.
DYNAMIC STABILITZATION OF Nb3Sn TAPE SUPERCONDUCTORS
K. Koyama and M. S. Lubell Oct. 1973 18 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4391) Avail: NTIS HC $3.00

The stabilization of Nb3Sn ribbon superconductor achieved by the interleaving of high conductivity aluminum has been experimentally investigated by observing the flux jumping on a rectangular stack placed in a changing transverse magnetic field. The results show that raising the conductivity of the aluminum leads to significantly increased stability as does increasing the thickness at fixed conductivity. The first flux jump field for both cases is given for various rates of increase of the applied transverse field. The limiting value at fast rates is compared to a new theory of dynamic stahbilization recently proposed by one of the authors (KK) and found to agree well for the case where the interleaved aluminum is thermally insulated from the superconductor. Agreement is not good when the aluminum is partially contributing to the thermal diffusion in an undetermined amount. Author (NSA)

N74-19375# Los Alamos Scientific Lab., N.Mex.
DESIGN OPTIONS AND TRADEOFFS IN SUPERCONDUCTING MAGNETIC ENERGY STORAGE WITH IRREVERSIBLE SWITCHING
H. L. Laquer, J. D. G. Lindsay, E. M. Little, J. D. Rogers, and D. M. Weldon 1973 21 p refs Presented at Symp. on Technol. of Controlled Thermonucl. Fusion Expt. and the Eng. Aspects of Fusion Reactors, Austin, Tex., 20 Nov. 1973 Sponsored by AEC
(LA-UR-73-910; Conf-731102-1) Avail: NTIS HC $3.25

A program is presently under way at Los Alamos to determine how superconducting magnetic energy storage in conjunction with normal-going superconducting switches can be made to deliver the energies of the order of 200 MJ that will be needed for plasma compression in a pulsed theta-pinch scientific feasibility experiment. After a review of the circuit configurations, the properties of commercially available and of some developmental superconductors relevant to both the energy storage coil and to the switch are discussed. Critical current densities at low fields and stability requirements both with respect to rapidly changing external fields and to self fields are of particular importance in determining optimum operating fields and temperatures. The tradeoff between eddy current losses in the stabilizing material and the need for coil protection if a coil normalcy should occur is described. Problems in potting or other forms of

mechanical stabilization for both superconducting elements are pointed out. Author (NSA)

N74-19376# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
MAGNETIC-FIELD INDUCED FAR-INFRARED TRANSMISSION IN BISMUTH
R. L. Blewitt and A. J. Sievers Jun. 1973 120 p refs
(Contract AT(11-1)-3151)
(COO-3151-26) Avail: NTIS HC $8.00

High magnetic fields render the semimetal bismuth sufficiently transparent at far infrared frequencies to study effects not previously seen in reflection experiments. The frequency interval 0.10 to 40 cm was explored at fields up to 100 kG using Fourier transform spectroscopic techniques and He3-cooled bolometer detectors, and samples were cooled to liquid helium temperatures. Transmission was observed in all three principal crystal directions when the magnetic field was sufficiently large to drive one or more sets of electrons into the extreme quantum limit. The reduced absorptivity at these fields results from a large reduction in the relaxation rate. NSA

N74-19377# Los Alamos Scientific Lab., N.Mex.
USAEC-DAT dc SUPERCONDUCTING POWER TRANSMISSION LINE PROJECT AT LASL Progress Report, 1 Mar. - 30 Jun. 1973
W. E. Keller, comp. and R. D. Taylor, comp. Aug. 1973 24 p
(Contract W-7405-eng-36)
(LA-5361-PR) Avail: NTIS HC $4.00

Progress is described in the areas of superconducting materials development, fabrication, and characterization; superconducting cable test-bed construction and instrumentation; and specifications for electrical power system studies incorporating dc superconducting transmission lines. Author (NSA)

N74-19378# Los Alamos Scientific Lab., N.Mex.
USAEC-DAT dC SUPERCONDUCTING POWER TRANSMISSION LINE PROJECT AT LASL Progress Report, 1 Nov. 1972 - 1 Mar. 1973
R. J. Bartlett, J. K. Hoffer, W. E. Keller, E. C. Kerr, T. E. McDonald, R. D. Taylor, W. J. Trela, A. L. Giorgi, and J. M. Dickinson May 1973 76 p
(Contract W-7405-eng-36)
(LA-5271-PR) Avail: NTIS HC $6.00

The aims of the SPTL project include a demonstration that incorporation of dc superconducting transmission lines into the present U.S. electrical utility power system is not only feasible but would lead to capital and operating economies compared with either conventional cable systems or superconducting ac lines, whenever large blocks of power are to be transmitted over long distances. The impact on the environment is minimal. The demonstration model is a line 1000 km long capable of carrying 5 GW of power, the type useful for carrying power from the Four Corners production complex to large urban areas in Phoenix, San Diego, or Los Angeles. The experiment includes data on superconducting samples, critical current measurements, test bed parameters, and power engineering studies. Author (NSA)

N74-19379# Minnesota Univ., Minneapolis.
CRITICAL PHENOMENA IN SUPERCONDUCTORS
J. C. Solinsky Dec. 1973 219 p refs Sponsored by AEC
(COO-1569-104) Avail: NTIS HC $13.00

Experimental studies were carried out with 1000 A thick dirty granular aluminum films which were evaporated onto mica substrates. The electrical conductivity and heat capacity were studied in the superconducting transition region. The resistive transition of the film was used as a thermometer in conjunction with optical heating in an ac calorimetry scheme to measure the films 5 x 10 to the minus 9th power J/K heat capacity. Results presented on four films indicate a rise in the heat capacity near the low temperature region of the transition where the film's resistance becomes zero. This rise peaked in two films studied to a value of up to 32 times the BCS jump in heat capacity and at a temperature of about 20 mK below the MFT transition temperature as determined from the conductivity measurements. An applied magnetic field widened and reduced the peak in the heat capacity while shifting it to a lower temperature. Author (NSA)

N74-19380# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENERGY LOSSES AND ELECTRON PATHS IN SINGLE CRYSTALS
A. A. Vorobev and B. A. Kononov 18 Dec. 1973 12 p refs Transl. into ENGLISH from Sb. Statei, Radiats, Fiz. Nemetallicheskikh Kristallov (KIEV), v. 3, no. 3, 1971 p 78-83
(AD-772015; FTD-HT-23-100-74) Avail: NTIS CSCL 20/12

The article describes the two characteristics of the passage of electrons with 1-10 MeV energy through a substance - path and energy losses. Single-crystal and pressed samples of halides of alkali metals and polycrystalline metals were used as absorbers. GRA

N74-19381# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A STRESS FUNCTION FORMULATION AND APPROXIMATE SOLUTION OF THE UNSYMMETRIC DEFORMATION PROBLEM FOR CRACKS IN NON-UNIFORM MATERIALS
Prasad Nair and Kenneth L. Reifsnider Sep. 1973 40 p refs
(Contract DAAF07-69-C-0444)
(AD-771128; VPI-E-73-31) Avail: NTIS CSCL 20/12

Relative stress and strain distributions are presented for the near-tip deformation field corresponding to a homogeneous cracked plate with spatially variable mechanical properties. Using a nonlinear (strain-hardening) stress-strain relationship and deformation plasticity, a first approximation asymptotic stress function solution was determined which shows that unsymmetric deformation fields develop in homogeneous materials with non-uniform properties. The amplitude of the stress singularity at the tip is also found to be dependent upon the non-uniformity. Experimental verification is presented showing extreme unsymmetry for an SEN specimen with a one-dimensional off-angle yield strength gradient. The engineering significance of the effect is discussed. Author (GRA)

N74-19382# Army Foreign Science and Technology Center, Charlottesville, Va.
SEMICONDUCTOR MICROCOOLER
B. A. Naer, I. Ya. Khirich, and P. N. Kravchenko 26 Jul. 1973 5 p Transl. into ENGLISH from Kholodiln. Tekhn. i Tekhnol (Kiev), 1970
(AD-772455; FSTC-HT-23-2147-72) Avail: NTIS CSCL 13/1

The construction of a new semi-conductor microcooler which can decrease the temperature of an object by 110-115 K is described in detail. Results of the testing of the microcooler are graphically represented. The microcooler can be used for studying thermophysical properties of objects in a wide range of temperatures and for conducting biological investigations. GRA

N74-19383# Cornell Univ., Ithaca, N.Y. Materials Science Center.
INTRINSIC FLUCTUATION EFFECTS AND CERTAIN OTHER ASPECTS OF SUPERCONDUCTING WEAK LINKS Ph.D. Thesis
Walter H. Henkels Jan. 1974 319 p refs Sponsored in part by AEC
(Contract N00014-67-A-0077-0016; NR Proj. 319-032)
(AD-773139; MSC-2110; COO-3156-57; TR-16) Avail: NTIS CSCL 20/12

The authors have experimentally observed the current-voltage behavior of various sorts of superconducting weak links, with and without applied electromagnetic fields. Observations have extended into the experimentally difficult regime very close to T(c). GRA

N74-19384# Systems Research Labs., Inc., Dayton, Ohio.
GRAVIMETRIC AND ELECTRICAL CONDUCTIVITY STUDIES OF PURE AND DOPED NIOBIUM PENTOXIDE Final Report
Walter C. Tripp and J. M. Wimmer (ARL) Wright-Patterson AFB, Ohio ARL Nov. 1973 39 p refs
(Contract AF 33(657)-2765; AF Proj. 7021)
(AD-773175; ARL-73-0157) Avail: NTIS CSCL 20/12

Thermogravimetric and electrical conductivity measurements on alpha Nb2O5 were made over the temperature range 900-1300 degree C in CO/CO2 mixtures and in pure oxygen. Anomalous conductivity results at low P(O)2 suggest the presence of nonstoichiometric phases. The data at higher P(O2) are analyzed on the basis of a defect model consisting of impurity control of the oxygen vacancy concentration at high P(O2) with a transition to a predominance of electrons and fully ionized oxygen vacancies at lower P(O2). The mobility, obtained by combining gravimetric and conductivity data, is shown to have negative temperature dependence with a value of 0.15 sq. cm/V-sec at 1000C. A value of -175 kcal/mole is obtained for the partial molar enthalpy of oxygen in Nb2O(5-x) over the range of x from 0.0025 to 0.01. (Modified author abstract) GRA

N74-19385# Texas Univ., Austin. Dept. of Physics.
AMORPHOUS SEMICONDUCTORS Semiannual Technical Report, 1 Apr. - 30 Sep. 1973
James C. Thompson 1973 23 p refs
(Grant DA-ARO(D)-31-124-73-G81; ARPA Order 1562)
(AD-772857; AROD-9687-6-P) Avail: NTIS CSCL 20/12

Section I contains the text of a paper (Effects of Pressure on Amorphous Semiconductors) read at the Fifth International Conference on Amorphous and Liquid Semiconductors (Gramisch-Partenkirchen, Germany, 1973). Section II contains an outline of the source of the errors in the a.c. data reported at Garmisch. Section III describes an improvement made in data taking procedures for sound speed measurements. Author (GRA)

N74-19386# Massachusetts Inst. of Tech., Cambridge.
BAND STRUCTURE AND ELECTRICAL PROPERTIES OF AMORPHOUS SEMICONDUCTORS Final Report
David Adler 15 Sep. 1973 34 p refs
(Contract DAHC04-70-C-0048; ARPA Order 1562)
(AD-772779; AROD-9181-24-P) Avail: NTIS CSCL 20/12

Contents: Studies of chalcogenide-glass threshold switching; Studies of memory-type chalcogenide alloys; Properties of bulk chalcogenide glasses; Studies of amorphous silicon and germanium; Theoretical studies of amorphous semiconductors; Non-ohmic and switching effects in chalcogenide-silicon heterojunctions. GRA

N74-19387# Army Foreign Science and Technology Center, Charlottesville, Va.
ELECTRICAL CONDUCTIVITY AND THERMOELECTRIC POWER OF MnO SINGLE CRYSTALS
R. N. Iskenderov 7 Dec. 1973 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR, Fiz. Tekhn. Mat. Nauk (Baku), no. 4, 1970 p 89-91
(AD-772454; FSTC-HT-23-2403-72) Avail: NTIS CSCL 20/12

The applicability of zone concepts to single crystal manganese oxide is discussed. The kinetic parameters - electrical conductivity and thermoelectric powers - are derived. It is found that mobility decreases with increasing temperature because of holes. A small radius bond is confirmed; however it is insufficient to form a small radius polaron. S.K.W.

N74-19329 Joint Publications Research Service, Arlington, Va.
PRODUCTION OF MONOCRYSTALS OF HIGH-MELTING METALS BY PLASMA-ARC HEATING
Ye. M. Savitskiy, G. S. Burkhanov, N. N. Raskatov, and G. D. Shnyrev *In its* Plasma Processes in Met. JPRS-61321 26 Feb. 1974 p 89-95 refs Transl. into ENGLISH from the book "Plazmennyye Protsessy v Metallurgii i Tekhnologii Neorganicheskikh Materialov" Moscow, Nauka, 1973 p 132-137 (For availability see N74-19322 10-25)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N74-19388 Stevens Inst. of Tech., Hoboken, N.J.
AN INVESTIGATION OF THE STEADY-STATE BURNING OF AMMONIUM PERCHLORATE COMPOSITE SOLID PROPELLANTS Ph.D. Thesis
Job Selvarayan Ebenezer 1973 144 p
Avail: Univ. Microfilms Order No. 74-869

A comprehensive steady-state model describing the burning of ammonium perchlorate (AP) - composite solid propellants has been formulated. The model is based on a flame structure consisting of a granular diffusion flame (after Summerfield) and a perturbed ammonium perchlorate AP decomposition flame; it is termed as the modified granular diffusion flame MGDF model. The MGDF model requires two experimental data points (matching points) to predict the influences of pressure, oxidant particle size, mixture ratio, and initial temperature on propellant burning rates. The MGDF model is shown to predict the effects of pressure, oxidant particle size, and mixture ratio which are in excellent agreement with the observed experimental influences of these parameters on propellant burning rates. Dissert. Abstr.

N74-19389*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLID PROPELLANT GRAIN STRUCTURAL INTEGRITY ANALYSIS Space Vehicle Design Criteria (Chemical Propulsion)
Jun. 1973 114 p refs
(NASA-SP-8073) Avail: NTIS HC $4.50 CSCL 21I

The structural properties of solid propellant rocket grains were studied to determine the propellant resistance to stresses. Grain geometry, thermal properties, mechanical properties, and failure modes are discussed along with design criteria and recommended practices. F.O.S.

N74-19390*# General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.
AN ANALYTICAL STUDY OF REDUCED-GRAVITY PROPELLANT SETTLING
R. D. Bradshaw and J. L. Kramer Feb. 1974 60 p refs
(Contract NAS3-16772)
(NASA-CR-134593; CASD-NAS-74-005) Avail: NTIS HC $6.00 CSCL 21A

Full-scale propellant reorientation flow dynamics were defined for the D-IT Centaur fuel tank. A computer code using the simplified marker and cell technique was modified to include the capability for a variable grid mesh configuration. The use of smaller cells near the boundary, near baffles and in corners provides improved flow resolution. The new program, structured in overlay, is more efficient in core usage and is suitable for larger size problems. Three drop tower model cases were simulated to verify program validity, two cases without baffles and one case with baffles and geometry identical to D-IT Centaur. Flow phenomena using the new code successfully modeled drop tower data. Flow trajectories off the baffles exhibited dependence on initial fluid location in relation to the baffle and on initial flow velocity. Two full-scale D-IT Centaur cases were then simulated using parameters based on the Centaur D-IT Proof Flight. Author

N74-19391# Michigan Univ., Ann Arbor. Dept. of Physics.
LIQUID HYDROGEN AS A FUEL FOR MOTOR VEHICLES; A COMPARISON WITH OTHER SYSTEMS
Lawrence W. Jones [1973] 4 p
Avail: NTIS HC $4.00

The pros and cons are explored of liquid hydrogen fuel, especially for smaller systems (automobiles and trucks). The alternative methods of liquid hydrogen fueling, whether by replaceable tanks or pumping from a storage vessel, are also discussed. Author

N74-19392# Rocket Propulsion Establishment, Westcott (England).
AN EXPERIMENTAL INVESTIGATION OF THE BURNING RATE OF PROPELLANT ANB 3066 UNDER OSCILLATORY PRESSURE AND OSCILLATORY VELOCITY CONDITIONS Final Scientific Report, Jun. 1972 - Jun. 1973
R. D. Gould and P. D. Penny Nov. 1973 52 p refs
(Contract F44620-72-C-0095)
(AD-772666; RPE-HCM/1/038; AFRPL-TR-73-9523) Avail:

NTIS CSCL 21/9

A program of work was conducted in order to measure the effects of oscillatory pressure and velocity at a frequency of 800 Hz upon the burning rate of ANB 3066. The burning rate was measured using a microwave interferometer method and also calculated from the pressure/time records of T-burner and KT-motor firings. An empirical relationship was derived which describes the burning rate under oscillatory and non-oscillatory conditions in terms of the average Mach number, the oscillatory pressure and the mean pressure at the propellant surface.
Author (GRA)

N74-19393# Naval Postgraduate School, Monterey, Calif.
NONMETALLIZED SOLID PROPELLANT IN HIGH ACCELERATION ENVIRONMENTS M.S. Thesis
Michael Abraham, III Sep. 1973 38 p refs
(AD-773075) Avail: NTIS CSCL 21/9

Nonmetallized double base propellant and ammonium perchlorate/binder sandwich combustion were studied in standard and high acceleration environments. Experimental techniques used were high speed motion pictures, two-color schlieren and pressure-time trace determination of burning rates. The double base propellant was studied at pressures to 1250 psia and accelerations to plus or minus 1000 g's. Two binder systems were used in the AP/binder sandwiches. Tests were conducted with two binder thicknesses at 400 psia and with acceleration levels of zero and 100 g's. It was found for double base propellant that the temperature increased continuously from the surface to the visible flame and that acceleration induced burning rate augmentation occurred. Acceleration apparently modified the surface or subsurface combustion zones. AP/binder sandwich combustion was found to be acceleration sensitive with binder flow being the most plausible mechanism. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N74-19394 Louisiana State Univ., Baton Rouge.
PERFORMANCE EVALUATION OF A ROCKET ENGINE Ph.D. Thesis
Mehmet Oe. Oezelsel 1973 174 p
Avail: Univ. Microfilms Order No. 73-27858

Equilibrium techniques predict specific impulse values for rocket motors which are higher than experimental results. The contention of this research is that this discrepancy in the results are largely due to an improper prediction of the equilibrium state. An alternate method involving a constrained free energy minimization is presented such that the boundary condition at the throat is satisfied. Results obtained with this model gives a significantly better agreement with test data and appears to a large degree to explain the empirical correction the energy release loss, which must be currently introduced from experimental evidence in performance analyses, and that combustor chamber geometry is a controlling factor in the combustion process. Calculations are presented utilizing this method and are compared against J-2 engine data. Dissert. Abstr.

N74-19395*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
EROSION IN RADIAL INFLOW TURBINES. VOLUME 1: EROSIVE PARTICLE TRAJECTORY SIMILARITY Final Report
W. B. Clevenger, Jr. and W. Tabakoff Feb. 1974 55 p refs
(Grant NGR-36-004-055)
(NASA-CR-134589) Avail: NTIS HC $5.75 CSCL 21E

Similarity parameters from the equations of motion of particles immersed in a gas flow are derived. These parameters relate the particles which follow a certain trajectory in an equivalent cold gas turbine to particles that will follow the same trajectory in a real hot gas turbine. Numerical solutions of the trajectories that particles follow in the vortex and rotor regions of a radial inflow turbine are used to verify the range of Reynolds numbers in which the derived similarity parameters are applicable. In addition, an example is presented of typical particle sizes that can be observed in high speed photographic data collection and at the same time simulate the trajectories of particles in a real hot gas turbine. Author

N74-19396*# General Electric Co., Cincinnati, Ohio.
HIGHLY LOADED MULTI-STAGE FAN DRIVE TURBINE - PERFORMANCE OF INITIAL SEVEN CONFIGURATIONS Final Report
G. W. Wolfmeyer and M. W. Thomas Washington NASA Feb. 1974 198 p refs
(Contract NAS3-14304)
(NASA-CR-2362; R73AEG154) Avail: NTIS HC $5.50 CSCL 21E

Experimental results of a three-stage highly loaded fan drive turbine test program are presented. A plain blade turbine, a tandem blade turbine, and a tangentially leaned stator turbine were designed for the same velocity diagram and flowpath. Seven combinations of bladerows were tested to evaluate stage performances and effects of the tandem blading and leaned stator. The plain blade turbine design point total-to-total efficiency was 0.886. The turbine with the stage three leaned stator had the same efficiency with an improved exit swirl profile and increased hub reaction. Two-stage group tests showed that the two-stage turbine with tandem stage two stator had an efficiency of 0.880 compared to 0.868 for the plain blade two-stage turbine. Author

N74-19397*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPULSION SYSTEM TESTS ON A FULL SCALE CENTAUR VEHICLE TO INVESTIGATE 3-BURN MISSION CAPABILITY OF THE D-LT CONFIGURATION
W. A. Groesbeck, K. M. Baud, R. F. Lacovic, W. K. Tabata, and S. V. Szabo, Jr. 5 Feb. 1974 168 p refs
(NASA-TM-X-71511; E-7889) Avail: NTIS HC $11.50 CSCL 21H

Propulsion system tests were conducted on a full scale Centaur vehicle to investigate system capability of the proposed D-IT configuration for a three-burn mission. This particular mission profile requires that the engines be capable of restarting and firing for a final maneuver after a 5-1/2-hour coast to synchronous orbit. The thermal conditioning requirements of the engine and propellant feed system components for engine start under these conditions were investigated. Performance data were also obtained on the D-IT type computer controlled propellant tank pressurization system. The test results demonstrated that the RL-10 engines on the Centaur vehicle could be started and run reliably after being thermally conditioned to predicted engine start conditions for a one, two and three burn mission. Investigation of the thermal margins also indicated that engine starts could be accomplished at the maximum predicted component temperature conditions with prestart durations less than planned for flight.
Author

N74-19398# Cambridge Univ. (England). Dept. of Engineering.
EFFECTS OF GROOVED CASING TREATMENT
C. Lakhwani 1972 25 p refs
(CUED/A-Turbo/TR-42) Avail: NTIS HC $4.25

An isolated compressor rotor blade row was tested with a solid-wall casing and with a circumferentially grooved casing over the rotor tip region. Comparisons are presented of overall characteristics and of pressure distributions around the blade near the tip and on the casing wall. The effect of Reynolds numbers on stall onset and stall cessation was also studied. The circumferentially grooved casing gives a small improvement in the operating flow range compared with the solid-wall casing. Author

N74-19399*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPERIMENTAL STUDY OF JET EXHUST SIMULATION PARAMETERS M.S. Thesis - George Washington Univ.
William B. Compton, III Aug. 1973 115 p refs

(NASA-TM-X-69961) Avail: NTIS HC $8.75 CSCL 21B

An investigation was conducted to determine the effect of varying the jet exhaust's ration of specific heats, gas constants, and temperatures on jet interference on afterbody drag. Jet exhaust simulation parameters were also evaluated. Besides air, three other exhaust gases, each with a different value of each of the gas parameters, were tested. Tests were made using a single nacelle model with afterbodies having boattail angles of 10 deg and 20 deg, and having sonic and Mach 2 jet exits. The investigation was conducted in a 16-foot transonic wind tunnel through a Mach number range of 0.60 to 1.20 at Reynolds numbers per meter from 10.06 x 1,000,000 to 14.05 x 1,000,000. Differences between the jet interference of the four exhaust gases ranged from 10 to 20 percent of the jet off drag at the low jet pressure ratios, and up to 35 percent of the jet off drag at a jet exit pressure ratio of 3. Author

N74-19400*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

QUIET ENGINE PROGRAM: TURBINE NOISE SUPPRESSION. -VOLUME 1: GENERAL TREATMENT EVALUATION AND MEASUREMENT TECHNIQUES

A. Clemons, H. Hehmann, and K. Radecki Dec. 1973 275 p refs

(Contract NAS3-12430)

(NASA-CR-134499; R73AEG443-Vol-1) Avail: NTIS HC $16.75 CSCL 21E

Acoustic treatment was developed for jet engine turbine noise suppression. Acoustic impedance and duct transmission loss measurements were made for various suppression systems. An environmental compatibility study on several material types having suppression characteristics is presented. Two sets of engine hardware were designed and are described along with engine test results which include probe, farfield, near field, and acoustic directional array data. Comparisons of the expected and the measured suppression levels are given as well as a discussion of test results and design techniques. Author

N74-19401*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

QUIET ENGINE PROGRAM: TURBINE NOISE SUPPRESSION. VOLUME 2: TREATMENT SELECTION, INSTALLATION, AND TEST RESULTS

A. Clemons, H. Hehmann, and K. Radecki Dec. 1973 282 p refs

(Contract NAS3-12430)

(NASA-CR-134586; R73AEG443-Vol-2) Avail: NTIS HC $17.25 CSCL 21E

For abstract, see N74-19400.

N74-19402# Cambridge Univ. (England). Dept. of Engineering.

A HODOGRAPH METHOD FOR THE DESIGN OF TRANSONIC TURBINE BLADES

D. E. Hobson Nov. 1972 22 p refs

(CUED, A-Turbo/TR-40) Avail: NTIS HC $4.25

A method is described for designing a class of highly loaded turbine blades having regions of supersonic flow near the suction surface. The variation of Mach number with flow direction on the blade surface may be specified and the corresponding blade shape calculated. The supersonic conditions may be computed from a knowledge of the prescribed sonic line stream function distribution. Author

N74-19403*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOME PROPULSION SYSTEM NOISE DATA HANDLING CONVENTIONS AND COMPUTER PROGRAMS USED AT THE LEWIS RESEARCH CENTER

Francis J. Montegani Washington Mar. 1974 70 p refs

(NASA-TM-X-3013; E-7609) Avail: NTIS HC $3.75 CSCL 20A

Methods of handling one-third-octave band noise data originating from the outdoor full-scale fan noise facility and the engine acoustic facility at the Lewis Research Center are presented. Procedures for standardizing, retrieving, extrapolating, and tasks. This information is useful as background for interpretation of data from these facilities appearing in NASA reports and can aid data exchange by promoting standardization. Author

N74-19404# Advisory Group for Aerospace Research and Development, Paris (France).

V/STOL PROPULSION SYSTEMS Technical Evaluation Report

H. Grieb (Motoren-und Turbinen-Union Muenchen GmbH) and N. A. Mitchell (Rolls Royce, Ltd.) Jan. 1974 12 p refs

(AGARD-AR-64) Avail: NTIS HC $4.00

The proceedings of a conference on propulsion systems for V/STOL aircraft are presented. The subjects discussed are: (1) propulsion system and airframe integration, (2) V/STOL propulsion system components, (3) environmental effects, and (4) V/STOL propulsion system operating experience. Author

N74-19405*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A SIMPLIFIED LIFE-CYCLE COST COMPARISON OF VARIOUS ENGINES FOR SMALL HELICOPTER USE

Kestutis C. Civinskas and Laurence M. Fishbach Feb. 1974 29 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland, Ohio

(NASA-TM-X-71517; E-7908) Avail: NTIS HC $4.50 CSCL 21A

A ten-year, life-cycle cost comparison is made of the following engines for small helicopter use: (1) simple turboshaft; (2) regenerative turboshaft; (3) compression-ignition reciprocator; (4) spark-ignited rotary; and (5) spark-ignited reciprocator. Based on a simplified analysis and somewhat approximate data, the simple turboshaft engine apparently has the lowest costs for mission times up to just under 2 hours. At 2 hours and above, the regenerative turboshaft appears promising. The reciprocating and rotary engines are less attractive, requiring from 10 percent to 80 percent more aircraft to have the same total payload capability as a given number of turbine powered craft. A nomogram was developed for estimating total costs of engines not covered in this study. Author

N74-19406# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

DEVELOPMENT OF A FUEL INJECTION SYSTEM FOR USE IN TRACER EXPERIMENTS ON MIXING IN DIESEL ENGINE COMBUSTION CHAMBERS

W. P. Mansfield Jan. 1974 48 p

(AASU-333) Avail: NTIS HC $5.50

The development of a new technique for studying mixing and combustion processes is discussed. In this technique, a small part of the fuel injected in each cycle is marked by adding a suitable material, and the spread of this material during and after combustion is followed photographically. The specific requirements of the injection system are that: (1) of the total amount of fuel injected in each cycle 10% approximately should be marked fuel, (2) the injection rate of this marked portion of the fuel should be approximately the same as that of the remainder, the injection period for the marked fuel thus being approximately 10% of the total injection period, and (3) the timing of the injection of marked fuel during the total injection period should be variable at will. A prototype system meeting these requirements, and of an alternative system allowing greater freedom of choice of the main injection conditions are described. Author

N74-19407# AiResearch Mfg. Co., Phoenix, Ariz.

PNEUMOMECHANICAL CRITICAL SPEED CONTROL FOR GAS TURBINE ENGINE SHAFTS Final Report, Oct. 1972 - Sep. 1973

R. A. Collins and D. E. Heuer Nov. 1973 98 p refs

(Contract F33615-72-C-2152)

(AD-772823; AFAPL-TR-73-102; Rept-73-310366) Avail: NTIS CSCL 21/5

The purpose of the program was to evaluate and demonstrate the feasibility of utilizing gas-lubricated foil bearings to resist high shaft excursions as the shaft advances through bending criticals and to determine the extent a shaft critical can be moved (increased) through use of these bearings. The program

to determine the loads imposed on the midspan foil bearing as the rotor advances through two predominantly bending critical speeds. The program resulted in a successful demonstration of the foil bearing as a device to diminish shaft excursion and shift the frequency of critical shaft speeds. (Modified author abstract) GRA

N74-19408# Army Foreign Science and Technology Center, Charlottesville, Va.
MULTIFUEL DIESEL ENGINES
I. I. Gershman and A. P. Lebedinskiy 30 Oct. 1973 221 p refs Transl. into ENGLISH of the book "Mnogotoplivnyye Dizeli" Moscow, Mashinostr., 1971 224 p
(AD-771198/9GA; FSTC-HT-23-1981-72) Avail: NTIS HC $13.25 CSCL 21/7

Soviet research and development in the field of creating multifuel motor vehicle diesel engines is described. Possible technical solutions directed at adapting the internal combustion engine to operation on various types of fuels are considered. GRA

N74-19409# Army Foreign Science and Technology Center, Charlottesville, Va.
INTERNAL COMBUSTION ENGINES, ISSUE 11
A. M. Gorkogo 24 Oct. 1973 218 p refs Transl. into ENGLISH of Dvigateli Vnutr. Sgoraniya (Kharkov), no. 11, 1970
(AD-771176/5GA; FSTC-HT-23-12-73) Avail: NTIS HC $13.00 CSCL 21/7

Gas flow in internal combustion engines is discussed. Supercharging processes, the effect of manifold conditions, valves and valve controls, and combustion chambers are studied. Other subjects include heat flow, transient processes, valve drive dynamics and lubrication and break-in. Author (GRA)

N74-19410# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
SIMPLIFIED LAY-OUT OF SUPERSONIC, HETEROGENEOUS EJECTORS Technical Report, Jun. 1972 - Apr. 1973
Siegfried H. Hasinger Nov. 1973 50 p ref
(AF Proj. 7116)
(AD-772675; ARL-73-0149) Avail: NTIS CSCL 21/5

A generalized analysis for supersonic ejectors with heterogeneous operating media and constant area mixing, which leads to a simple diagram for determining approximate values of ejector mass and area ratio, driver-gas Mach-number and temperature, is presented. Simplifications are obtained by considering that conservation of momentum and continuity dominates the ejector process, while conservation of energy, a condition which complicates ejector calculations, is of little influence in case of a supersonic ejector and amenable to an approximate treatment. The ejector layout diagram is also modified to provide information on off-design conditions. In a separate treatment the approximate ejector analysis is used as a first step for a refined layout, which more accurately observes conservation of energy, requiring an iteration process for a solution. (Modified author abstract) GRA

N74-19411# Boeing Vertol Co., Philadelphia, Pa.
INVESTIGATION AND ANALYSIS OF RELIABILITY AND MAINTAINABILITY PROBLEMS ASSOCIATED WITH ARMY AIRCRAFT ENGINES Final Report
K. G. Rummel and H. J. M. Smith Aug. 1973 222 p refs
(Contract DAAJ02-71-C-0055; DA Proj. 1F1-62205-A-119)
(AD-772950; D210-10571-1; USAAMRDL-TR-73-28) Avail: NTIS CSCL 21/5

The reliability and maintainability problems associated with gas turbine engines currently operational with the U.S. military services were examined in the report. A broad spectrum of turboshaft and turboprop engines in U.S. Army, Navy and Marine helicopters and fixed-wing aircraft was examined. The study concentrated on the detailed R and M experience of the T53, T55, T58, T64, T73 and T74, although quantitative R-M data is provided on other gas turbine engines in military and commercial service. (Modified author abstract) GRA

N74-19412# Mechanical Technology, Inc., Latham, N.Y.
PNEUMOMECHANICAL CRITICAL SPEED CONTROL FOR GAS TURBINE ENGINE SHAFTS Technical Report, 30 May 1972 - 1 Sep. 1973
Richard A. Cundiff, Robert H. Badgley, and Jere M. Reddecliff (Pratt and Whitney Aircraft Corp.) Nov. 1973 115 p refs
(Contract F33615-72-C-1801)
(AD-772805; MTI-73TR42; AFAPL-TR-73-101) Avail: NTIS CSCL 21/5

Initial evaluation of the use of gas-lubricated intershaft foil bearings to reduce inner spool vibration levels in small gas-turbine aircraft engines has been successfully concluded. A Hydresil intershaft foil bearing was applied to a power turbine shaft simulator operating on elastically-mounted ball bearings without support damping. A series of tests showed that the two-pad and three-pad Hydresil bearings are superior to the 360-degree bearing for the journal size and rotor speeds tested. Rotor balancing via the recently-developed MTI Multiplane-Multispeed Balancing Procedure was used to suppress the first (bending) shaft-bearing system critical speed and a pedestal resonance, and to leave a distinct vibration peak at the second (bending) critical speed. (Modified author abstract) GRA

N74-19413# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BY-PASS ENGINES
G.-Predtechenskii 30 Nov. 1973 14 p Transl. into ENGLISH from Grazhdanskaya Aviats. (USSR), no. 6, Jun. 1973 p 24-25
(AD-772723; FTD-HT-23-537-74) Avail: NTIS CSCL 21/5

The report describes the design and performance of Soviet designed jet aircraft bypass engines. GRA

N74-19414# Hamilton Standard, Windsor Locks, Conn.
OVERSTRESS QUALIFICATION TEST OF THE MULTIPLE SATELLITE DISPENSER 5 LBF ROCKET ENGINE ASSEMBLY REA 16-9
Joseph Genovese 10 Dec. 1973 196 p refs
(Contract N00014-73-C-0322)
(AD-772489; SVHSER-6303) Avail: NTIS CSCL 21/8

The report presents the results of a portion of a Qualification Overstress Test on Hamilton Standard Rocket Engine Assembly, Model 16-9, a nominal 5.0 pound thrust monopropellant engine. The objectives of this portion of the Qualification Overstress Tests were to characterize the engine over extended life and at various operating conditions. GRA

N74-19415# Hamilton Standard, Windsor Locks, Conn.
OVERSTRESS QUALIFICATION TEST OF THE MULTIPLE SATELLITE DISPENSER 0.2 LBF ROCKET ENGINE ASSEMBLY REA 10-16
William Arkilander Nov. 1973 41 p refs
(Contract N00014-73-C-0322)
(AD-772491; SVHSER-6304) Avail: NTIS CSCL 21/8

The report presents the results of a portion of a qualification overstress test on Hamilton Standard Rocket Engine Assembly 10-16, a nominal 0.2 footpounds thrust hydrazine monopropellant engine. This phase of the testing was concerned with verification of nozzle thrust coefficients and critical soakback testing of the REA. GRA

N74-19416# Hamilton Standard, Windsor Locks, Conn.
OVERSTRESS QUALIFICATION TEST FOR THE MULTIPLE SATELLITE DISPENSER 5 lb SUB f ROCKET ENGINE ASSEMBLY REA 16-9
J. Genovese 23 Oct. 1973 60 p
(Contract N00014-73-C-0322)
(AD-772487; SVHSER-6302) Avail: NTIS CSCL 21/8

The report presents the results of a portion of a Qualification Overstress test program on Hamilton Standard Rocket Engine Assembly 16-9, a nominal 5.0 lbf hydrazine monopropellant engine. This phase of the testing was concerned with verification of the nozzle thrust coefficients and critical soakback testing of the REA. Thrust calibration testing showed that the analytical predictions for thrust coefficient are within 1% of the experimental data, but that a 1% decrease in the input thrust coefficient table is indicated. GRA

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N74-19417 California Inst. of Tech., Pasadena.
A STUDY OF COSMIC-RAY POSITRON AND ELECTRON SPECTRA IN INTERPLANETARY AND INTERSTELLAR SPACE AND THE SOLAR MODULATION OF COSMIC RAYS Ph.D. Thesis
Alan Coffman Cummings 1973 281 p
Avail: Univ. Microfilms Order No. 73-31038

The differential energy spectra of cosmic ray positrons and negatrons with energies between approximately 11 and 1500 MeV during the period 1968 to 1971 were measured using a balloon borne magnetic spectrometer. These measurements determine, within quantitative limits, the interstellar spectra of cosmic ray positrons and electrons. From a study of the near earth electron spectra and their relationship to the interstellar spectrum derived from the galactic nonthermal radio background emission, and from a study of the near earth positron spectra and their relationship to the interstellar positron spectrum calculated from collisions of cosmic ray nuclei with the interstellar matter, it was found that the differential energy spectrum of interstellar electrons may be represented as a power law, but must flatten considerably at lower energies. It was concluded that the majority of cosmic ray electrons with energies above approximately 10 MeV are not the result of nuclear collisions in the galaxy but presumably originate in primary sources.
Dissert. Abstr.

N74-19418 California Inst. of Tech., Pasadena.
COSMIC-RAY SCINTILLATIONS Ph.D. Thesis
Aaron James Owens 1973 197 p
Avail: Univ. Microfilms Order No. 73-31053

The observation and theoretical interpretation of a new physical phenomenon are reported. Cosmic-ray scintillations are temporal fluctuations in the counting rate of a detector pointing in a fixed direction in space. Power-spectral analyses of energetic-particle counting rate data are used to demonstrate that scintillations are a statistically significant, persistent, and interesting feature of the cosmic-ray flux observed near earth for a wide range of frequencies and energies. The observed power spectra of cosmic-ray scintillations are approximately power laws in frequency with exponents of -1.5 to -2.0, and for protons the relative scintillations are a rapidly-decreasing function of energy.
Dissert. Abstr.

N74-19419+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LATITUDINAL DISTRIBUTIONS OF SOLAR OPTICAL FLARES
K. RamanujaRao Nov. 1972 16 p refs
(INPE-266-RI/055) Avail: NTIS HC $4.00

The latitudinal distribution of solar flares show that there are more than one maximum of their occurrence in any one year. This phenomenon is envisaged as due to the continuous generation of a pulse at higher latitudes and its migration towards the equator in about 5 years.
Author

N74-19420# Potchefstroom Univ. for Christian Higher Education (South Africa). Dept. of Physics.
COSMIC RAY NEUTRON MONITOR DATA, POTCHEFSTROOM, JANUARY - DECEMBER 1973
Mar. 1974 38 p
(P-3) Avail: NTIS HC $5.00

Cosmic ray neutron monitor data are presented in tabular form. Data are given on pressure corrected and uncorrected counts.
E.H.W.

N74-19421# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SHORT PERIODICITIES IN SOLAR ACTIVITY
K. RamanujaRao Sep. 1972 15 p refs
(Proj. RADA-SOL)
(INPE-240-RI/039) Avail: NTIS HC $4.00

Several indices of solar activity are subjected to a high pass filter and power spectral analysis to verify the existance of shorter periodicities in solar activity. Though all these indices show the presence of short periodicities, above 95% confidence level, the common indices like sunspot number, fail to show these periodicities when a stringent statistical test is applied. The basic parameters, however, reveal the presence of 5.6 and 3.5 year periodicities even when this stringent statistical test is applied.
Author

N74-19422*# Linguistic Systems, Inc., Cambridge, Mass.
INFRARED SPECTRA OF THE RADIATION OF THE EARTH INTO OUTER SPACE
Yu. G. Andrianov, I. I. Karavayev, Yu. P. Safronov, and V. I. Tulupov Washington NASA Mar. 1974 123 p refs Transl. into ENGLISH of the book "Infrakrasnyye Spektry Izlucheniya Zemli v Kosmos" Moscow, Sov. Radio, 1973 112 p
(Contract NASw-2482)
(NASA-TT-F-15064) Avail: NTIS HC $9.25 CSCL 03B

Results are described of measurements of the intensity of infrared radiation of the earth into outer space, obtained with the use of a spectral apparatus, mounted on board artificial earth satellites. Some basic propositions of the theory of the radiation of the earth are presented and a survey of substantial articles on this question is given. The procedure and results of statistical processing of measurements of infrared spectra of the radiation of the earth in the range of wave lengths from 7 to 26 microns are described. Statistical characteristics and histograms of laws of the distribution of intensities of radiation at various wave lengths are given. Correlation dependences between intensities of radiation in various ranges of wave lengths and histograms of two-dimensional laws of the distribution of these magnitudes are considered. Results of measurements are compared with data obtained by American scientists.
Author

N74-19423*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRIMARY GAMMA RAYS
C. E. Fichtel Feb. 1974 37 p refs
(NASA-TM-X-70612; X-662-74-57) Avail: NTIS HC $5.00 CSCL 03B

Within this galaxy, cosmic rays reveal their presence in interstellar space and probably in source regions by their interactions with interstellar matter which lead to gamma rays with a very characteristic energy spectrum. From the study of the intensity of the high energy gamma radiation as a function of galactic longitude, it is already clear that cosmic rays are almost certainly not uniformly distributed in the galaxy and are not concentrated in the center of the galaxy. The galactic cosmic rays appear to be tied to galactic structural features, presumably by the galactic magnetic fields which are in turn held by the matter in the arm segments and the clouds. On the extragalactic scale, it is now possible to say that cosmic rays are not universal at the density seen near the earth. The diffuse celestial gamma ray spectrum that is observed presents the interesting possibility of cosmological studies and possible evidence for a residual universal cosmic ray density, which is much lower than the present galactic cosmic ray density.
Author

N74-19424*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DISCUSSION OF INTERPLANETARY POST-SHOCK FLOWS WITH TWO EXAMPLES
Keith W. Ogilvie and Leonard F. Burlaga Jan. 1974 27 p refs Submitted for publication
(NASA-TM-X-70611; X-692-74-49) Avail: NTIS HC $4.50 CSCL 03B

Plasma and magnetometer observations are described for two flare-associated shock flows and the comparison of them with models. One represents a class of flows where the shock is followed by a stream and separated from it by a region in which density temperature and speed decrease monotonically. The other is characterized by a complex region between the shock and the following stream, which has many discontinuities and fluctuations, but in which there is no increase in helium concentration. These two types of flow can be distinguished using ground magnetograms, since the former shows no sudden

impulses following the shock, whereas the latter shows many.
Author

N74-19425# Osservatorio Astronomico, Rome (Italy).
A METHOD OF SPECTRAL CLASSIFICATION USING LOW DISPERSION SPECTRA IN THE PHOTOGRAPHIC INFRARED
R. Buonanno and F. Smriglio (Rome Univ.) Feb. 1973 12 p refs
(RR-6) Avail: NTIS HC $4.00

A densitometric method based on spectrophotometric measurement of the relative strength of near infrared molecular bands is described. The limitations of this method are discussed when applied to early M-type stars classified by TiO band at 7054 A and late M-type stars classified by TiO bands at 7589A and 8432A.
ESRO

N74-19426# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
COMPUTER SIMULATIONS OF COSMIC RAY AIR SHOWERS. 2: SHOWERS INITIATED BY HEAVY PRIMARY PARTICLES
H. E. Dixon, K. E. Turver, and C. J. Waddington Nov. 1973 28 p refs Prepared in cooperation with Imp. Coll. of Sci. and Technol. and Durham Univ.
(Contract N00014-67-A-0133-0021)
(AD-772622) Avail: NTIS CSCL 04/1

Computer simulations have been made of large extensive air showers initiated by nuclei heavier than protons. The work forms part of a study of future experiments designed to identify the nature of the energetic primary particles. A model based upon data from nuclear emulsion experiments has been used to represent the break-up of the primary nuclei in collision with air nuclei. Differences in shower characteristics are predicted which are dependent upon the choice of model for the fragmentation of the primary nucleus and its energy. The major cause of fluctuations in the longitudinal development of showers produced by heavy primary particles is shown to be the pattern of the fragmentation of the incident nucleus. (Modified author abstract)
GRA

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N74-19427 Colorado Univ., Boulder.
THE DISTRIBUTION OF ATOMIC HYDROGEN IN THE THERMOSPHERE AND EXOSPHERE OF MARS AS DETERMINED FROM MARINER 6, 7 AND 9 ULTRAVIOLET MEASUREMENTS Ph.D. Thesis
Donald Ellsworth Anderson, Jr. 1973 123 p
Avail: Univ. Microfilms Order No. 73-32504

Four Lyman-alpha airglow measurements of the limb and disc of Mars, made by ultraviolet spectrometers on Mariner 6 and 7 in 1969 and Mariner 9 in 1971, are analyzed to determine the amount and distribution of atomic hydrogen above 80 km. It is found that: (1) the exospheric temperature and distribution in 1971 is consistent with that determined in 1969; (2) the vertical optical depth above 80 km is 2.2 in 1969 and 5 in 1971; and (3) the derived atomic hydrogen distribution from 80 km to 250 km requires a source of atomic hydrogen above 80 km. Comparison of observed atomic hydrogen profiles with chemical-diffusion models implies a large downward flow of atomic hydrogen at 80 km coupled with a large upward flow of molecular hydrogen.
Dissert. Abstr.

N74-19428 California Inst. of Tech., Pasadena.
THE FORMATION OF PLANETESIMALS, 1. TIDAL FRICTION AND GENERALIZED CASSINI'S LAWS IN THE SOLAR SYSTEM, 2 Ph.D. Thesis
William Roger Ward 1973 103 p
Avail: Univ. Microfilms Order No. 73-31055

Four stages in the accretion of planetesimals are described. The initial stage is the condensation of dust particles from the gaseous solar nebula as it cools. These dust particles settle into a thin disk which is gravitationally unstable. A first generation of planetesimals, whose radii range up to approximately .1 kilometer, form from the dust disk by direct gravitational collapse to solid densities on a time scale of order one year. The resulting disk, composed of first generation planetesimals, is still gravitationally unstable and the planetesimals are grouped into clusters containing approximately 10,000 members. An investigation is made of a dynamical problem which has considerable application to the solar system. The evolution of the obliquity of an object is determined when under the influence of three phenomena: (1) the precession of the object's orbit plane; (2) the precession of the object's spin axis; and (3) tidal friction.
Dissert. Abstr.

N74-19429 Washington Univ., St. Louis, Mo.
THE DIFFUSE INTERSTELLAR BANDS: A CORRELATION ANALYSIS, WITH COMMENTS ON SUGGESTED ORIGINS Ph.D. Thesis
Theodore Peck Snow, Jr. 1973 116 p
Avail: Univ. Microfilms Order No. 74-851

Data on diffuse interstellar bands in 159 stars are used to test various hypotheses concerning the origins of the bands. Measurements of the radial velocities of the 5780 and 5797 diffuse lines, and of the strengths of the 4430, 4760, 4890, 5780, 5797, and 6180 features are used in this study. The wavelengths of the 5797 diffuse lines are measured with respect to the D lines of sodium in two groups of stars, whose average interstellar sodium velocities differ by 19.4 km/sec. The wavelengths agree to within the standard deviation of the measurements, indicating that the diffuse line absorption and the sodium absorption take place in the same interstellar clouds. The results of this study are not inconsistent with the hypothesis that the 4430 band is produced by calcium atoms absorbed on dust grains while the 5780 and 5797 features are formed by sodium atoms on grains.
Dissert. Abstr.

N74-19430 Maryland Univ., College Park.
POLARIZATION OF SUPERNOVA REMNANTS AT CENTIMETER WAVELENGTHS Ph.D. Thesis
Thangasamy Velusamy 1973 200 p
Avail: Univ. Microfilms Order No. 74-269

A survey of the distributions of intensity and linear polarization at 11 cm in supernova remnants in the northern sky was made using the 300-ft telescope of the National Radio Astronomy Observatory. Twenty-two supernova remnants were mapped in both total and polarized intensities and seven were mapped in total intensity only. Additional observations of the distributions of intensity and polarization at 6 and 2.8 cm were made with the 140-ft telescope in order to investigate the Faraday rotation effects in some of the supernova remnants. The angular resolutions of the present observations at 11, 6 and 2.8 cm were 5.5, 6 and 3 min respectively. The results indicate that the galactic sources G53.9 + 0.3, G54.4 - 0.3, G69.0 + 2.7 and G93.4 + 1.8 are possible supernova remnants which until now are not listed as such in any of the catalogs. The characteristics of the observed sources are discussed using the presently available observations of intensity and polarization of these sources.
Dissert. Abstr.

N74-19431+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ANALYSIS OF THE NON-GAUSSIAN SPECTRA OF INTERPLANETARY SCINTILLATIONS
S. K. Alurkar, R. P. Sarker, and V. BrahamanandaRao Aug. 1972 25 p refs
(Proj. RASA 2)
(INPE-224-RI/025) Avail: NTIS HC $4.25

The non-Gaussian intensity fluctuation spectra are analysed. Computations of the length scales derived from the phase autocorrelation functions using Buckley's method indicate that for a r.m.s. phase deviation of 4 radians or more the diffracting medium behaves as one with its phase structure having inner and outer scales of turbulent blobs or eddies which are present in a turbulent medium.
Author

N74-19432*# California Inst. of Tech., Pasadena.
INFRARED SKY NOISE STUDY Final Report
J. A. Westphal 31 May 1972 21 p
(Grant NGR-05-002-184)
(NASA-CR-137074) Avail: NTIS HC $4.00 CSCL 03B

The hardware and techniques to measure and compare sky noise at several sites were studied, and a device was developed that would maximize its output and minimize its output for modulation. The instrument and its functions are described. The nature of sky emissions and the fluctuation, gaseous sources of sky noise, and aerosol sources are discussed. It is concluded that sky noise really exists, and the spatial distribution of the sky noise sources are such that observed noise values are linear functions of chopping stroke. F.O.S.

N74-19433*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
DEVELOPMENT OF LUNAR NOMENCLATURE Final Report
Donald H. Menzel [1973] 4 p refs
(Grant NGR-09-015-209)
(NASA-CR-137074; Rept-311-013) Avail: NTIS HC $4.00 CSCL 05B

A system of unification and standardization for lunar nomenclature was developed. The following recommendations were made for use in future lunar cartography: (1) satellite craters, previously designated by letters will be named; (2) names will no longer be restricted to scientists, but will also include great contributors to human knowledge and human culture; and (3) a system of grids for dividing the moon into 144 regions and subdividing these regions into 2304 provinces will be used. S.K.W.

N74-19434*# California Univ., Berkeley. Dept. of Astronomy.
STUDY OF THE ATMOSPHERIC CONDITIONS AFFECTING INFRARED ASTRONOMICAL MEASUREMENTS AT WHITE MOUNTAIN, CALIFORNIA Final Report
George B. Field 24 Jan. 1974 70 p
(Grant NGR-05-003-459)
(NASA-CR-137082) Avail: NTIS HC $6.50 CSCL 03A

Measurements are described of atmospheric conditions affecting astronomical observations at White Mountain, California. Measurements were made at more than 1400 times spaced over more than 170 days at the Summit Laboratory and a small number of days at the Barcroft Laboratory. The recorded quantities were ten micron sky noise and precipitable water vapor, plus wet and dry bulb temperatures, wind speed and direction, brightness of the sky near the sun, fisheye lens photographs of the sky, description of cloud cover and other observable parameters, color photographs of air pollution astronomical seeing, and occasional determinations of the visible light brightness of the night sky. Measurements of some of these parameters have been made for over twenty years at the Barcroft and Crooked Creek Laboratories, and statistical analyses were made of them. These results and interpretations are given. The bulk of the collected data are statistically analyzed, and disposition of the detailed data is described. Most of the data are available in machine readable form. A detailed discussion of the techniques proposed for operation at White Mountain is given, showing how to cope with the mountain and climatic problems. Author

N74-19435*# Techtran Corp., Glen Burnie, Md.
ESTIMATES OF THE INTENSITY OF TURBULENCE IN THE ATMOSPHERES OF MARS AND VENUS
G. S. Golitsyn and V. I. Tatarskiy Washington NASA Mar. 1974 8 p refs Transl. into ENGLISH from the publ. "Fizika Luny i Planet" Moscow, Nauka, 1972 p 394-397
(Contract NASw-2485)
(NASA-TT-F-15431) Avail: NTIS HC $4.00 CSCL 03B

The levels of velocity, temperature and refractive index fluctuations are estimated for the atmospheres of Mars and Venus on the basis of free-convection and dynamic models. The first model provides the average turbulence dissipation rate and the rate of equalization of temperature gradients by assuming that the lower portion of the atmosphere is subject to convective mixing. The second model is based on an analysis of the global influx of solar energy, with an estimate of the portion that is converted to generate kinetic motions in the atmosphere. According to both models, the velocity fluctuations are several times higher on Mars and lower on Venus than on Earth. The two models provide different levels of temperature fluctuations, and the possible reasons for this are explored. Author

N74-19436*# National Aeronautics and Space Administration, Washington, D.C.
EVOLUTIONARY AND PHYSICAL PROPERTIES OF METEOROIDS
Curtis L. Hemenway, ed. (Dudley Obs.), Peter M. Millman, ed. (NRC), and Allan F. Cook, ed. (Smithsonian Astrophys. Obs.) 1973 361 p refs Proc. of the Intern. Astron. Union's Colloq. no. 13, Albany, N. Y., 14-17 Jun. 1971
(NASA-SP-319; LC-72-600319) Avail: NTIS MF $1.45; SOD HC $4.30 CSCL 03B

Astrophysical models for meteoroid formation and stellar and planetary evolutions are developed from simulation composition studies. For individual titles, see N74-19437 through N74-19474.

N74-19437* National Research Council of Canada, Ottawa (Ontario).
PHOTOGRAPHIC FIREBALL NETWORKS c14
Ian Halliday *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 1-8 refs (For availability see N74-19436 10-30)
CSCL 14E

Three networks for the photography of bright fireballs are now in operation; in the central United States, central Europe and western Canada. A detailed comparison is made of the parameters which describe the three networks. Although only two meteorites for which photographic orbital data are available have been recovered, the networks are contributing valuable data on fireball orbits, influx rates and problems of meteor physics. Author

N74-19438* Smithsonian Astrophysical Observatory, Cambridge, Mass.
A DETERMINATION OF METEOR MASS DISTRIBUTION FROM METEOR ECHOES
G. Forti *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 9-12 refs (For availability see N74-19436 10-30)
(Contract NSR-09-015-033)
CSCL 03B

Meteor counts from observations at four magnitudes in the range of about +9 to +15 in the visual scale were used to determine the exponent of the mass distribution law under certain assumptions. Since for these data no range measures were available, and since the pattern of the transmitting/receiving antennas was very broad, the same range and radiant distribution were assumed for all counts within the same half hour during which individual counts at different magnitudes were obtained. These echo counts, covering in five successive days 24 hr with overlapping periods, yielded for the exponent a value of 1.95 + or - 0.02, close to other determinations. Individual values, however, presented a considerable scatter, probably reflecting changes in radiant and mass distribution over the year. From the same data, it appeared that the mass exponent changed during the day, yielding generally a higher value for the evening hours. Author

N74-19439* Smithsonian Astrophysical Observatory, Cambridge, Mass.
RECOMBINATION IN RADAR METEORS
Richard B. Southworth *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 13-21 refs (For availability see N74-19436 10-30)
(Contract NSR-09-015-033)
CSCL 03B

Recombinations in the ionized columns generated by faint radar meteors are observed as: (1) A rapid loss of returned signal in the first few milliseconds after formation of the column; (2) an apparent absence of bright, low meteors; and (3) anomalies in apparent diffusion rates. Recombination at rates characteristic of dissociative recombination of ionized atmospheric molecules N2(+) and O2(+) is completely consistent with the observations. It appears either that the molecules are ionized in the initial

formation of the ionized column or that there is rapid charge exchange. Recombination is a sufficient cause for the differences between diffusion measures and other atmospheric studies.
Author

N74-19440* Smithsonian Astrophysical Observatory, Cambridge, Mass.
COMBINED OBSERVATIONS OF METEORS BY IMAGE-ORTHICON TELEVISION CAMERA AND MULTI-STATION RADAR c07
A. F. Cook, G. Forti, R. E. McCrosky, A. Posen, R. B. Southworth, and J. T. Williams *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 23-44 refs (For availability see N74-19436 10-30)
(Contract NSR-09-015-033)
CSCL 17I

Observations from multiple sites of a radar network and by television of 29 individual meteors from February 1969 through June 1970 are reported. Only 12 of the meteors did not appear to fragment over all the observed portion of their trajectories. From these 12, the relation for the radar magnitude to the panchromatic absolute magnitude was found in terms of velocity of the meteor. A very tentative fit to the data on the duration of long enduring echoes versus visual absolute magnitude is made. The exponential decay characteristics of the later parts of several of the light curves are pointed out as possible evidence of mutual coalescence of droplets into which the meteoroid has completely broken. Author

N74-19441* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MASS INFLUX OBTAINED FROM LOW-LIGHT-LEVEL TELEVISION OBSERVATIONS OF FAINT METEORS
Robert J. Naumann and K. Stuart Clifton *In its* Evolutionary and Phys. Properties of Meteoroids 1973 p 45-52 refs (For availability see N74-19436 10-30)
CSCL 03B

Low light level television systems offer the ability to observe meteors as faint as 10th magnitude which allows the extension of optical meteor data to masses as small as 0.0001 gram. The results of these observations, using image orthicons and intensified vidicons, are presented along with an interpretation in terms of mass flux. This interpretation includes the development of a relationship between peak luminosity of a meteor and mass, velocity, and zenith angle that was derived from single body meteor theory and compares favorably with results obtained from the artificial meteor program. Also included in the mass flux interpretation is an analysis of the observation response of a LLLTV system to fixed and moving point sources. Author

N74-19442* TRW Systems Group, Redondo Beach, Calif.
DETERMINATION OF METEOR PARAMETERS USING LABORATORY SIMULATION TECHNIQUES
J. F. Friichtenicht and D. G. Becker *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 53-81 refs (For availability see N74-19436 10-30)
CSCL 03B

Atmospheric entry of meteoritic bodies is conveniently and accurately simulated in the laboratory by techniques which employ the charging and electrostatic acceleration of macroscopic solid particles. Velocities from below 10 to above 50 km/s are achieved for particle materials which are elemental meteoroid constituents or mineral compounds with characteristics similar to those of meteoritic stone. The velocity, mass, and kinetic energy of each particle are measured nondestructively, after which the particle enters a target gas region. Because of the small particle size, free molecule flow is obtained. At typical operating pressures (0.1 to 0.5 torr), complete particle ablation occurs over distances of 25 to 50 cm; the spatial extent of the atmospheric interaction phenomena is correspondingly small. Procedures have been developed for measuring the spectrum of light from luminous trails and the values of fundamental quantities defined in meteor theory. It is shown that laboratory values for iron are in excellent agreement with those for 9 to 11 km/s artificial meteors produced by rocket injection of iron bodies into the atmosphere. Author

N74-19443* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LABORATORY DETERMINATION OF THE LUMINOUS EFFICIENCY OF METEOR CONSTITUENTS
Howard F. Savage and Charles A. Boitnott *In its* Evolutionary and Phys. Properties of Meteoroids 1973 p 83-87 refs (For availability see N74-19436 10-30)
CSCL 03B

A crossed beam apparatus has been used to measure the emission and ionization cross sections for the prominent spectral features of Na, Ca, Mg, and Fe in collisions with N2 and O2 over the velocity range of 30 to 120 km/s. From the emission and ionization cross sections, the absolute luminous efficiencies in air were determined over the range of meteor velocities. The maximum luminous efficiencies for the brightest features were: greater than 1 percent for the Na D-lines, 0.2 percent for the Ca I(2) singlet, 0.06 percent for the Mg I(2) and Mg I(3) triplets, and 0.4 percent for Fe over the visible spectral range. These luminous efficiencies are valid for free molecular flow conditions for velocities above about 30 km/s and are directly applicable to spectroscopic observations of faint meteors. In contrast to previous work, the luminous efficiency found for stone in the present investigation decreased with velocity above about 50 km/s. Author

N74-19444* Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
EVIDENCE FROM SPECTRA OF BRIGHT FIREBALLS
Zdenek Ceplecha *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 89-102 refs (For availability see N74-19436 10-30)
CSCL 03B

Spectral data with dispersions from 11 to 94 A/mm on 4 fireballs of actual brightness of -4 to -12 magnitude and with velocities of about 30 km/s at 70 to 80 km heights are used for studies of meteor radiation problems. The radiation of fireballs is found to be strongly affected by self absorption. But if the emission curve of growth is used for correction of the self absorption of Fe I lines, a great discrepancy between spectral data and efficiency data for total Fe I light is found. If one assumes that the self absorption is superposed on another effect, a decrease of the dimensions of the radiating volume with increasing lower potential, the spectral data on Fe I lines will be in agreement with the luminous efficiency of total Fe I meteor radiation. Formulas for emission curve of growth and Boltzmann distribution including this effect are derived. This effect is important for fireballs brighter than about -1 or -2 magnitude, while self absorption seems to be important even for fainter meteors.
Author

N74-19445* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPECTRAL ANALYSIS OF FOUR METEORS
Gale A. Harvey *In its* Evolutionary and Phys. Properties of Meteoroids 1973 p 103-129 refs (For availability see N74-19436 10-30)
CSCL 03B

Four meteor spectra are analyzed for chemical composition and radiative processes. The chemical compositions of the Taurid, Geminid, and Perseid meteors were found to be similar to that of a typical stony meteorite. The chemical composition of the sporadic meteor was found to be similar to that of a nickel iron meteorite. The radiation from optical meteors was found to be similar to that of a low temperature gas, except that strong, anomalous ionic radiation is superposed on the neutral radiation in bright, fast meteors. Author

N74-19446* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA-LRC FAINT METEOR SPECTRA
Gale A. Harvey *In its* Evolutionary and Phys. Properties of Meteoroids 1973 p 131-139 refs (For availability see N74-19436 10-30)
CSCL 03B

A brief description is given of the instrumentation, the facilities, and the patrol technique used by the NASA faint meteor spectra patrol. A classification of 500 meteor spectra obtained in the first 2-1/2 years of the patrol is reported. The general

characteristics of typical spectra are discussed and preliminary conclusions drawn. Examples of unusual spectra are briefly described. Author

N74-19447* University of Southern Calif., Los Angeles.
THE AURORAL GREEN LINE IN PERSEID SPECTRA NEAR SUNSPOT MAXIMUM
John A. Russell *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 141-146 refs (For availability see N74-19436 10-30)
CSCL 03B

Thirty-one spectra photographed during the Perseid showers of 1969 and 1970 are found to exhibit greater ionization and stronger, more frequent appearance of the forbidden oxygen line at 5577 A than Perseid spectra obtained with the same instrument in 1961. Data from 13 Perseid showers indicate a relationship between the frequency of occurrence of the oxygen line and solar activity. In 1969-70, near sunspot maximum, the strength of this auroral green line is greatest near shower maximum, as though the nature of the meteoroids were a function of their distance from the core of the stream, or, alternatively, the strength of the green line were a function of the altitude of the radiant. Author

N74-19448* National Research Council of Canada, Ottawa (Ontario).
IMAGE-ORTHICON SPECTRA OF GEMINIDS IN 1969
P. M. Millman, A. F. Cook (Smithsonian Astrophys. Obs.), and C. L. Hemenway (State Univ. of New York) *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 147-151 refs (For availability see N74-19436 10-30)
CSCL 03B

The spectra of 25 meteors, recorded with an image orthicon technique in December 1969, are studied in relation to similar records made in August of the same year. Of 19 Geminid meteors in the absolute visual magnitude range 0 to +2, only one showed any evidence of the forbidden line of oxygen at 5577 A, while all Perseid meteors recorded in August exhibited the oxygen line, a result of the large difference in geocentric velocity between the two showers. Atoms identified in faint Geminid meteors include neutral iron, magnesium, calcium and sodium. The molecular bands of nitrogen are also observed. Author

N74-19449* Smithsonian Astrophysical Observatory, Cambridge, Mass.
AN UNUSUAL METEOR SPECTRUM
A. F. Cook, C. L. Hemenway (State Univ. of New York, Albany), P. M. Millman (NRC), and A. Swider (State Univ. of New York, Albany) *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 153-159 refs (For availability see N74-19436 10-30)
CSCL 03B

An extraordinary spectrum of a meteor at a velocity of about 18.5 + or - 1.0 km/s was observed with an image orthicon camera. The radiant of the meteor was at an altitude of about 49 deg. It was first seen showing a yellow red continuous spectrum alone at a height of 137 + or - 8 km which is ascribed to the first positive group of nitrogen bands. After the meteor had descended to 116 + or - 6 km above sea level it brightened rapidly from its previous threshold brightness into a uniform continuum, the D-line of neutral sodium appeared, and at height 105 + or - 5 km all the other lines of the spectrum also appeared. The continuum remained dominant to the end. Water of hydration and entrained carbon flakes of characteristic dimension about 0.2 micron or less are proposed as constituents of the meteoroid to explain these phenomena. Author

N74-19450* National Research Council of Canada, Ottawa (Ontario).
SPECTROSCOPY OF PROJECT FIRE 1, APRIL 14, 1964 c31
Peter M. Millman *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 161-167 refs (For availability see N74-19436 10-30)
CSCL 04A

The Fire 1 test was designed to study the heating of an Apollo-type reentry vehicle. The total reentry complex weighed approximately 230 kg and entered the upper atmosphere at a velocity of 11.5 km/s. The spectrum of the reentry complex has been studied in the wavelength range 3700 to 8800 A, where 102 multiplets of 21 atoms and the band systems of 5 diatomic molecules have been identified. Comparisons with meteor spectra are made. Author

N74-19451* Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
MOTION OF A FRAGMENT IN DISTURBED AIR BEHIND A METEOR BODY c12
V. Padevet *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 169-174 refs (For availability see N74-19436 10-30)
CSCL 20D

The effect of disturbed air behind the meteor body on the motion and ablation of fragments observed partly as the difference between the photometrically and the dynamically determined masses of the meteor body. By use of extreme mathematical conditions, this difference can be made to reach orders of magnitude during the latter part of the trajectory. Author

N74-19452* Lund Observatory (Sweden).
THE DISTRIBUTION OF 1/a IN PHOTOGRAPHIC METEOR ORBITS
B. A. Lindblad *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 175-181 refs (For availability see N74-19436 10-30)
CSCL 03B

The distribution of reciprocal semi-major axes in photographic meteor orbits is studied. A detailed classification of the orbits is made according to quality. The distribution of 1/a in precise orbits is multimodal with two broad maxima approximately centered on 0.05 and 0.40 (AU)/1. Minima in the distribution appear near 0.20 and 0.66 (AU)/1 corresponding to Jupiter's and Mars' position in the 1/a diagram. Considerable fine structure appears in the 1/a distribution. Resonance gaps corresponding to commensurabilities with Jupiter are detected. The gaps are similar to the well studied Kirkwood gaps in the asteroid belt. Author

N74-19453* Smithsonian Astrophysical Observatory, Cambridge, Mass.
A WORKING LIST OF METEOR STREAMS
Allan F. Cook *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 183-191 refs (For availability see N74-19436 10-30)
(Grant NGR-09-015-033)
CSCL 03B

The list is restricted to meteor streams that do exist; included are six streams with activity near the threshold of detection by photography not related to any known comet and not shown to be active for as long as a decade. Author

N74-19454* National Research Council of Canada, Ottawa (Ontario).
ORIGIN AND EVOLUTION OF RECENT LEONID METEOR SHOWERS
Bruce A. McIntosh *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 193-198 refs (For availability see N74-19436 10-30)
CSCL 03B

The four most prominent returns of the Leonid shower in the past decade fall into two broad classes. The 1966 and 1969 showers were of short duration, had a high proportion of small particles, and occured with the longest apparent delay after the perihelion passage of the parent comet Temple-Tuttle. By contrast, the 1961 and 1965 returns were of long duration, and had more large particles. The 1961 return preceded the comet. There are three major influences on particle orbits: ejection velocity, radiation pressure, and close encounters with planets. The observations are explainable in a qualitative way on the basis of the first two. But some speculation concerning the results of planetary perturbations are invoked. Author

N74-19455* Smithsonian Astrophysical Observatory, Cambridge, Mass.
NEW EVIDENCE FOR INTERPLANETARY BOULDERS?
Zdenek Sekanina *In* NASA, Washington Evolutionary and Phys.

Properties of Meteoroids 1973 p 199-208 refs (For availability see N74-19436 10-30)
CSCL 03B

The method of detection, the magnitude and the rate of occurrence of sudden disturbances in the motions of some short period comets are discussed. The disturbances have recently been suggested as potential indicators of collisions between the comets and interplanetary boulders - minor objects whose existence was predicted. The character of explosive phenomena, caused by an impact of such a boulder on a comet's nuclear surface, depends significantly on the surface texture of the target body. A method is suggested which supplies a good deal of the missing information about the structure and optical properties of nuclear surfaces from precise photometric observations of cometary nuclei at large solar distances. Author

N74-19456* Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
COSMIC DUST IN THE ATMOSPHERE AND IN THE INTERPLANETARY SPACE AT 1 AU TODAY AND IN THE EARLY SOLAR SYSTEM
H. Fechtig *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 209-221 refs (For availability see N74-19436 10-30)
CSCL 03B

A description of techniques used in recent experiments to detect and analyze cosmic dust and micrometeorites is given and the results both from the study of lunar crater statistics and from in situ measurements are reviewed. The results from lunar crater statistics show an agreement with the results obtained from in situ measurements in interplanetary space and derived from zodiacal light measurements. The near earth results show an enhancement in the flux numbers. This can be caused either by secondary lunar debris or by disintegration of low density fireballs in the outer atmosphere. Author

N74-19457* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DUST STORMS IN SPACE?
Robert G. Roosen, Otto E. Berg, and Neil H. Farlow *In its* Evolutionary and Phys. Properties of Meteoroids 1973 p 223-226 refs (For availability see N74-19436 10-30)
CSCL 03B

Primarily from the Pioneer 8 and 9 results, it is concluded that the flux of picogram sized dust particles near the earth's orbit has been constant to within the observational limits over three years of observation. In particular, since dust streams are not observed, they cannot explain microphone detected events. However, the possibility of rare events due to dust blown directly off a cometary nucleus (such as that reported for Comet Bennett) cannot be completely ruled out. Author

N74-19458* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LUNAR ROCKS AS METEOROID DETECTORS
Jack B. Hartung, Friedrich Hoerz, and Donald E. Gault *In its* Evolutionary and Phys. Properties of Meteoroids 1973 p 227-239 refs (For availability see N74-19436 10-30)
CSCL 03B

About 5000 microcraters on seven lunar rocks recovered during the Apollo 12 mission have been systematically studied using a stereomicroscope. Based on comparisons with laboratory cratering experiments, at least 95 percent of all millimeter sized craters observed were formed by impacts in which the impact velocity exceeded 10 km/s. The dynamics of particle motion near the moon and the distribution of microcraters on the rocks require an extralunar origin for these impacting particles. The microcrater population on at least one side of all rocks studied was in equilibrium for millimeter sized craters; i.e., statistically, craters a few millimeters in diameter and smaller were being removed by the superposition of new craters at the same rate new craters were being formed. The population of craters on such a surface is directly related to the total population of particles impacting that surface. Crater size distribution data together with an experimentally determined relationship between the crater size and the physical parameters of the impacting particle, yield the mass distribution of interplanetary dust at 1 AU. Author

N74-19459* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ARTIFICIAL METEOR ABLATION STUDIES
Maxwell B. Blanchard *In its* Evolutionary and Phys. Properties of Meteoroids 1973 p 241-254 refs (For availability see N74-19436 10-30)
CSCL 03B

Artificial meteor ablation was performed on natural minerals, composed predominately of magnetite and hematite, using an arc heated plasma stream of air. Analysis of the ablated debris indicated most was composed of two or more minerals. The more volatile elements were depleted and the relative abundance of Fe increased as a result of both volatile depletion and a reduction in its oxidation state. Hematite was converted to magnetite in the ablation zone, and quartz and apatite minerals were converted to an Fe-rich glass consisting of varying amounts of Si, P, Cl, and Ca, depending upon the accessory minerals available at the time of melting. Artificially created ablation products from iron oxides exhibited unique properties depending on the composition of the original material and the environmental conditions of formation. In addition to the accepted elemental criteria, these properties were morphologic characteristics, textural parameters, and the existence of metastable minerals. Author

N74-19460* Dudley Observatory, Albany, N.Y.
POSSIBLE EVIDENCE OF ABLATION ON COSMIC DUST PARTICLES
Curtis L. Hemenway (State Univ. of N. Y., Albany) *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 255-257 refs (For availability see N74-19436 10-30)
CSCL 03B

Scanning electron micrographic studies on trapped particles collected shortly after the Leonid meteor shower exhibit surface ablation and spherical formation. G.G.

N74-19461* Academy of Sciences (USSR), Moscow. Astronomical Council.
ABLATION IN METEORS
V. N. Lebedinets *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 259-269 refs (For availability see N74-19436 10-30)
CSCL 03B

A comparison of theoretical calculations with the results of radar meteor observations shows that the theory of radio meteors satisfactorily represents observational data. Radar meteor observations are incompatible with the idea of low density for small meteoroids in the ablation process. The main mechanism of ablation is evaporation. During intensive evaporation, small meteoroids have a density close to that of usual stone meteorites. Author

N74-19462* Rome Univ. (Italy).
A POSSIBLE MECHANISM FOR THE CAPTURE OF MICROPARTICLES BY THE EARTH AND OTHER PLANETS OF THE SOLAR SYSTEM
F. DiBenedetto *In* NASA, Washington Evolutionary, and Phys. Properties of Meteoroids 1973 p 271-274 ref (For availability see N74-19436 10-30)
CSCL 03B

By application of Lyttleton's theory for the formation of comets, it is shown that a possible mechanism for the origin and formation of a concentration of cosmic particles around the earth and the other planets of the solar system exists. In the vicinity of the neutral point, where the velocity of colliding particles is not greater than 6 km/s, it is found that if the solid particles after collision must remain in a solid state, there can be no possibility of accretion for Mercury, Mars, and the Moon, where the maximum value of the distance of the center of the planet to the asymptotic trajectory is less than the radius of the planet. On the other hand, the capture radii of microparticles in solid form varies from a minimum of 2.95 planetary radii for Venus and 3.47 for the Earth, to about 986 for Jupiter. Author

N74-19463* Odessa Polytechnic Inst. (USSR).
ON THE INFLUENCE OF THE ATMOSPHERIC DUST ON THE ZODIACAL LIGHT POLARIZATION
N. B. Divari and S. N. Krylova *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 275-280 refs

(For availability see N74-19436 10-30)
CSCL 03B

Three color observations of the nightglow brightness and polarization were made to determine the brightness of zodiacal light at the ecliptic pole. On the assumption that the degree of polarization of zodiacal light is 0.20 at the ecliptic pole, the corresponding brightnesses are found to be 68, 70, and 96 G2 stars of the 10th magnitude per square deg. at 0.37, 0.53, and 0.58 micron. The large diurnal variations in observed intensity and direction of polarization are attributed to the effects of dust in the earth's atmosphere. Author

N74-19464* Odessa Polytechnic Inst. (USSR).
OPTICAL PROPERTIES OF ATMOSPHERIC DUST FROM TWILIGHT OBSERVATIONS
N. B. Divari, Y. I. Zaginayilo, and L. V. Kovalchuk *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 281-285 refs (For availability see N74-19436 10-30)
CSCL 03B

Three methods of approximation are described and used to separate the primary twilight brightness from the observed brightness. Photoelectric observations obtained are combined with observations from a balloon and from the observatory to derive the atmospheric scattering phase functions of 0.37 micron and 0.58 micron as a function of height. Comparison of these data with data for a Rayleigh atmosphere provide information on the optical properties of dust in the upper atmosphere. Author

N74-19465* Dudley Observatory, Albany, N.Y.
UNUSUAL CHEMICAL COMPOSITIONS OF NOCTILUCENT-CLOUD PARTICLE NUCLEI
Curtis L. Hemenway (State Univ. of N. Y., Albany) *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 287-290 refs (For availability see N74-19436 10-30)
Avail: NTIS CSCL 03B

Two sounding rocket payloads were launched from the ESRO range in Sweden during a noctilucent cloud display. Large numbers of submicron particles were collected, most of which appear to be made up of a high density material coated with a low density material. Typical electron micrographs are shown. Particle chemical compositions have been measured by use of dispersive X-ray analysis equipment attached to an electron microscope and have revealed that most of the high density particle nuclei have atomic weights greater than iron. Author

N74-19466* Washington Univ., Seattle.
THE PHYSICAL NATURE OF INTERPLANETARY DUST AS INFERRED BY PARTICLES COLLECTED AT 35 km
Donald E. Brownlee, Paul W. Hodge, and William Bucher *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 291-295 refs (For availability see N74-19436 10-30)
(Grant NGR-48-002-033)
CSCL 03B

Particles were collected at an altitude of 35 km by two flights of a volume sampling micrometeorite collector. The collection scheme is very sensitive and is capable of collecting a significant number of particles. Many of the particles collected have chemical compositions similar to solar or to iron meteorites. Morphology of collected particles indicates that both true micrometeorites and ablation products were collected. Author

N74-19467* Gesellschaft fuer Weltraumforschung m.b.H., Bad Godesberg (West Germany).
ON THE MANGANESE CONTENT OF COSMIC FLAKES FROM DEEP-SEA SEDIMENTS
Karl Utech *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 297-298 ref (For availability see N74-19436 10-30)
CSCL 03B

Cosmic flakes belong to the category of cosmic microparticles. They occur together with cosmic spherules in sediments. These flakes appear to represent ablation products of iron meteorites burnt away during the passage of a meteorite through the atmosphere by friction against air molecules. Microprobe analyses of flakes from deep sea deposits proved the particles to consist of magnetite which in most cases had been altered into maghemite in the outer zones. This is in agreement with the assumption that they represent fragments of fusion crust of iron meteorites. Most of the flakes, however, contained a small percentage of manganese. This element is not a common constituent of iron meteorites. An attempt is made to explain the presence of manganese in flakes and its absence in cosmic spherules. Author

N74-19468* TRW Systems, Redondo Beach, Calif.
THE COSMIC DUST ANALYZER: EXPERIMENTAL EVALUATION OF AN IMPACT IONIZATION MODEL c11
J. F. Friichtenicht, N. L. Roy, and D. G. Becker *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 299-310 refs (For availability see N74-19436 10-30)
CSCL 14B

A thermal equilibrium plasma model is used to process data from an impact ionization time-of-flight mass spectrometer in order to convert the raw ion data to relative abundances of the elemental constituents of cosmic dust particles. Author

N74-19469* California Univ., La Jolla.
ON THE PRIMORDIAL CONDENSATION AND ACCRETION ENVIRONMENT AND THE REMANENT MAGNETIZATION OF METEORITES
Aviva Brecher *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 311-329 refs (For availability see N74-19436 10-30)
(Grant NGL-05-009-002)
CSCL 03B

In the context of various models for the early evolution of a solar nebula, the possible roles assigned to ambient magnetic fields and the paleointensities required to establish the stable natural remanent magnetization observed in meteorites, are discussed. It is suggested that the record of paleofields present during condensation, growth, and accumulation of grains is likely to have been preserved as chemical or thermochemical remanence in unaltered meteoritic material. Fine particle theories appear adequate for treating meteoritic remanence, if models based on corresponding types of permanent magnet materials, e.g., powder ferrites for chondrites and diffusion hardened alloys for iron meteorites, are adopted. Author

N74-19470* Slovak Academy of Sciences, Bratislava (Czechoslovakia).
THE COMETARY AND ASTEROIDAL ORIGINS OF METEORS
Lubor Kresak *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 331-341 refs (For availability see N74-19436 10-30)
CSCL 03B

A quantitative examination of the gravitational and nongravitational changes of orbits shows that for larger interplanetary bodies the perturbations by Jupiter strongly predominate over all other effects, which include perturbations by other planets, splitting of comet nuclei and jet effects of cometary ejections. The structure of meteor streams, indicates that the mutual compensation of the changes in individual elements entering the Jacobian integral, which is characteristic for the comets, does not work among the meteoroids. It appears that additional forces of a different kind must exert appreciable influence on the motion of interplanetary particles of meteoroid size. Nevertheless, the distribution of the Jacobian constant in various samples of meteor orbits furnishes some information on the type of their parent bodies and on the relative contribution of individual sources. Author

N74-19471* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
THE EARLY EVOLUTION OF THE SOLAR SYSTEM
A. G. W. Cameron (Yeshiva Univ.) *In its* Evolutionary and Phys. Properties of Meteoroids 1973 p 347-353 refs Sponsored in part NSF (For availability see N74-19436 10-30)
CSCL 03B

The problems of relating collapse conditions in an interstellar cloud to a model of the primitive solar nebula are discussed. In such a nebula there is a radial force balance between gravity, the pressure gradient, and centrifugal forces due to the rotation. Approximate values are given for the combinations of temperature and density throughout the nebula, from a maximum of about

2000 K near the center to less than 200 K in the outer portion. These conditions are based upon the compression adiabats in the terminal stages of the collapse of an interstellar cloud. One general conclusion, of great importance for accumulation of bodies within the solar system, is that interstellar grains should not be completely evaporated at distances in the nebula beyond about one or more astronomical units. Author

N74-19472* Smithsonian Astrophysical Observatory, Cambridge, Mass.
RADIAL PRESSURE IN THE SOLAR NEBULA AS AFFECTING THE MOTIONS OF PLANETESIMALS
Fred L. Whipple (Harvard Coll. Obs., Cambridge, Mass.) *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 255-361 refs (For availability see N74-19436 10-30)
CSCL 03B

Growing planetesimals and a range of drag laws depending on the Reynolds number and on the ratio of particle size to mean free path are considered. Particles spiral in the direction of positive gradient, thus being concentrated toward toroidal concentrations of gas. The effect increases with decreasing rates of particle growth, i.e., with increasing time scales of planet formation by accretion. In the outer regions, where evidence suggests that comets were formed and Uranus and Neptune were so accumulated, the effect of the pressure gradient is to clear the forming comets from those regions. The large mass of Neptune may have developed because of this effect, perhaps Neptune's solar distance was reduced from Dode's law, and perhaps no comet belt exists beyond Neptune. In the asteroid belt, on a slow time scale, the effect may have spiraled planetesimals toward Mars and Jupiter, thus contributing to the lack of planet formation in this region. Author

N74-19473* Bellcomm, Inc., Washington, D.C.
CURRENT EVOLUTION OF METEOROIDS
J. S. Dohnanyi *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 363-374 refs (For availability see N74-19436 10-30)
CSCL 03B

The observed mass distribution of meteoroids at 1 AU from the sun is briefly reviewed in a survey that ranges over the bulk of the mass spectrum from micrometeoroids to meteorite parent objects. The evolution of meteoroids under the influence of collisions, planetary perturbations, the Poynting-Robertson effect and radiation pressure is then discussed. Most micrometeoroids are expelled from the solar system by radiation pressure shortly after their production as secondary ejecta during impact by larger objects or as dust ejected by comets. Particles that survive will eventually be swept out by the Poynting-Robertson effect. Meteoroids in the radio and photographic ranges are destroyed in collisions faster than they can be replaced by the production of secondary fragments during collisions between larger objects. Author

N74-19474* State Univ. of New York, Albany.
POSSIBLE INTERACTION OF INTERSTELLAR PARTICLES WITH THE SOLAR AND TERRESTRIAL ENVIRONMENT
J. Mayo Greenberg (Dudley Obs., Albany, N. Y.) *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 375-377 refs (For availability see N74-19436 10-30)
(Grant NGR-33-011-043)
CSCL 03B

The possibility for detection of interstellar particles in the earth's environment is considered on the basis of the passage of the solar system through the interstellar medium. Among the forces which inhibit interstellar particle penetration, the deflection by the solar magnetic field and the repulsive force due to the radiation from the sun are by far the most important. Author

N74-19475*# Scientific Translation Service, Santa Barbara, Calif.
CURRENT CONCEPTS REGARDING THE MOON
K. P. Florenskiy, ed., A. A. Gurshteyn, ed., A. T. Bazilevskiy, and M. N. Izakov Washington NASA Feb. 1974 226 p refs Transl. into ENGLISH of the book "Sovremennyye Predstavleniya o Lune" Moscow, Nauka Press, 1972 p 1-125
(Contract NASw-2035)
(NASA-TT-F-766) Avail: NTIS HC $6.00 CSCL 03B

The current status of scientific concepts regarding the moon is examined. The goals of the study of the moon from the earth are presented, and an attempt is made to generalize the data obtained in recent years by means of space vehicles. Articles are presented giving the results of investigating the lunar soil by means of Luna 16, a geological-morphological analysis of telescopic pictures of the lunar surface, investigations of the moon's intrinsic radiation, development of the fundamentals of lunar cartography, simulation of lunar soil and processes occurring on the surface of the moon, as well as the problems involved in drilling on the lunar surface. For individual titles, see N74-19476 through N74-19483.

N74-19476* Scientific Translation Service, Santa Barbara, Calif.
PRELIMINARY DATA ON THE LUNAR SOIL COLLECTED BY THE LUNA 16 AUTOMATIC PROBE
A. P. Vinogradov *In its* Current Concepts Regarding the Moon (NASA-TT-F-766) Feb. 1974 p 1-24 ref Transl. into ENGLISH of the book "Sovremennyye Predstavleniya o Lune" Moscow, Nauka Press, 1972 p 7-20 (For availability see N74-19475 10-30)
CSCL 03B

The results of preliminary studies of a sample of lunar soil taken by the automatic probe Luna 16 are given. Information on the granulometric characteristics of the regolith, its optical properties, types of rocks, and mineral composition are described. The chemical composition of macro- and microelements for different parts of the core sample is determined for the lunar basalt. The isotopic composition of inert gases of certain elements is studied. The age was established by the Rb/Sr method as 4.85 to 4.25 billion years. Author

N74-19477* Scientific Translation Service, Santa Barbara, Calif.
THE PROBLEM OF THE STRUCTURE OF THE SURFACE OF THE LUNAR MARIA
K. P. Florenskiy, A. T. Bazilevskiy, A. A. Gurshteyn, R. B. Zezin, A. A. Pronin, V. P. Polosukhin, Z. V. Popova, and I. M. Taborko *In its* Current Concepts Regarding the Moon (NASA-TT-F-766) Feb. 1974 p 25-62 refs Transl. into ENGLISH of the book "Sovremennyye Predstavleniya o Lune" Moscow, Nauka Press, 1972 p 21-45 (For availability see N74-19475 10-30)
CSCL 03B

The results are described of geological and morphological interpretation of large-scale photographs of the surface of lunar maria. A morphological classification is proposed for small craters. It is shown that the classification of a crater in a given morphological category, reflecting the degree of its morphological maturity, is determined by the age of the given crater. A check on the nature of distribution of small craters, as done on the basis of the nearest neighbor method, show that the distribution is governed by a near-random law. It is found that variations of the probability density function for the craters conform to a normal distribution law. An empirical relation is found for the coefficient of variation as a function of crater diameter and the dimensions of the area on which the counts are made. The rockfalls near craters of various morphological classes are described. Author

N74-19478* Scientific Translation Service, Santa Barbara, Calif.
RESULTS OF INVESTIGATION OF THE SURFACE LAYER OF THE MOON ON THE BASIS OF ITS INTRINSIC RADIATION
V. S. Troitskiy and T. V. Tikhonova *In its* Current Concepts Regarding the Moon (NASA-TT-F-766) Feb. 1974 p 63-96 refs Transl. into ENGLISH of the book "Sovremennyye Predstavleniya o Lune" Moscow, Nauka Press, 1972 p 47-64 (For availability see N74-19475 10-30)
CSCL 03B

The intrinsic thermal radiation of the moon is an indicator of the temperature regime of the lunar surface, its physical conditions and structure, as indicated by data from Luna 9 and 13, as well as Surveyor 1 to 7. Author

N74-19479* Scientific Translation Service, Santa Barbara, Calif.

GEOLOGICAL MAPPING OF THE MOON
M. S. Markov, A. L. Sukhanov, V. G. Trifonov, P. V. Florenskiy, and L. M. Shkerin *In its* Current Concepts Regarding the Moon (NASA-TT-F-766) Feb. 1974 p 97-138 refs Transl. into ENGLISH of the book "Sovremennyye Predstavleniya o Lune" Moscow, Nauka Press, 1972 p 65-87 (For availability see N74-19475 10-30)
CSCL 03B

Compilation and labelling of geological and morphological charts on a scale of 1:1,000,000 are discussed with emphasis on the regions of Maria Tranquilitatis, Crisium, Fecunditatis, Humorum and Nukium as well as certain prominent craters.
Author

N74-19480* Scientific Translation Service, Santa Barbara, Calif.
CLASSIFICATION, SCALE SERIES AND NOMENCLATURE OF LUNAR CHARTS **c13**
K. P. Florenskiy, A. A. Gurshteyn, V. I. Korablev, L. M. Bugayevskiy, and K. B. Shingarev *In its* Current Concepts Regarding the Moon (NASA-TT-F-766) Feb. 1974 p 139-154 Transl. into ENGLISH of the book "Sovremennyye Predstavleniya o Lune" Moscow, Nauka Press, 1972 p 88-96 (For availability see N74-19475 10-30)
CSCL 08B

Lunar charts are classified with an eye toward solution of special problems of lunar cartography. The initial state of mapping the moon will require charts with scales of 1:5,000,000; 1:1,000,000; 1:250,000; 1:50,000; and 1:10,000. Author

N74-19481* Scientific Translation Service, Santa Barbara, Calif.
LABORATORY SIMULATION OF PROCESSES OF EVAPORATION, CONDENSATION, AND SPUTTERING TAKING PLACE ON THE SURFACE OF THE MOON
M. D. Nusinov, V. A. Kochnev, Yu. B. Chernyak, A. V. Kuznetsov, A. I. Kosolapov, and O. I. Yakovlev *In its* Current Concepts Regarding the Moon (NASA-TT-F-766) Feb. 1974 p 155-185 refs Transl. into ENGLISH of the book "Sovremennyye Predstavleniya o Lune" Moscow, Nauka Press, 1972 p 97-112 (For availability see N74-19475 10-30)
CSCL 03B

Study of evaporation, condensation and sputtering on the moon can provide information on the same processes on other planets, and reveal details of the formation of the lunar regolith. Simulation methods include vacuum evaporation, laser evaporation, and bubbling gas through melts. Author

N74-19482* Scientific Translation Service, Santa Barbara, Calif.
DEVELOPMENT OF AN ANALOG OF LUNAR SOIL
Z. A. Atsagortsyan, G. G. Akopyan, R. R. Sarkisov, I. I. Cherkasov, and V. V. Shvarev *In its* Current Concepts Regarding the Moon (NASA-TT-F-766) Feb. 1974 p 186-191 refs Transl. into ENGLISH of the book "Sovremennyye Predstavleniya o Lune" Moscow, Nauka Press, 1972 p 113-116 (For availability see N74-19475 10-30)
CSCL 03B

Volcanic tuff from the Artik deposit in Armenia is especially suited for experiments in simulating lunar soil, with the aid of compaction by vibration. Author

N74-19483* Scientific Translation Service, Santa Barbara, Calif.
US STUDIES IN THE FIELD OF SHAFT DRILLING ON THE LUNAR SURFACE **c15**
B. V. Zakharyev and V. G. Kardysh *In its* Current Concepts Regarding the Moon (NASA-TT-F-766) Feb. 1974 p 192-205 refs Transl. into ENGLISH of the book "Sovremennyye Predstavleniya o Lune" Moscow, Nauka Press, 1972 p 117-124 (For availability see N74-19475 10-30)
CSCL 13I

American equipment for drilling in the lunar surface is discussed, with emphasis on rotary-percussive methodology and core-sample retrieval techniques. Author

N74-19484*# Kanner (Leo) Associates, Redwood City, Calif.
A UNIFIED SYSTEM OF SELENODETIC COORDINATES FROM NINE CATALOGUES ON THE VISIBLE HEMISPHERE OF THE MOON
Yu. N. Lipskiy, V. A. Nikonov, and T. P. Skobeleva Washington NASA Feb. 1974 217 p refs Transl. into ENGLISH of the book "Yedinaya Sistema Selenodezicheskikh Koordinat is Devyati Katalogov na Vidimom Polusharii Luni" Moscow, Nauka Press 384 p
(Contract NASw-2481)
(NASA-TT-F-813) Avail: NTIS HC $5.75 CSCL 03B

A position of the moon's center of mass was determined in the Mills-2 system with + or - (0.2 to 0.35) km accuracy along the axes. It was derived by a special procedure from the Rangers 6, 7, 8, 9, Surveyors 1, 3, 6, 7, Lunar Orbiter 1, Apollo 11, and radar and photogrammetric measurements. On the basis of nine selenodetic catalogues, hypsometric maps were constructed for the region + or - 70 deg longitude. Isohypses were drawn at 0.5 and 1.0 km intervals, taking account of relief. From discrepancies in the middle levels of 10 deg x 10 deg trapezia, the mutual positions of the catalogue centers were determined by the areal method. The same method was used to derive the position of the center of figure of the visible hemisphere with + or - (0.1 to 0.2) km accuracy from the middle levels of the same trapezia for four of the most extensive catalogues. After reduction of the nine catalogues to a common center, the mutual orientation of coordinate axes was determined by Euler angles from the discrepancies of longitudes and latitudes of common points. Accuracy of the results is + or - (0.002 to 0.004 deg) on the average. All nine catalogues were further reduced to the moon's center of mass. Author

N74-19485# Joint Publications Research Service, Arlington, Va.
LEGAL ASPECTS OF MANNED SPACEFLIGHT AND REMOTE SENSING OF THE ENVIRONMENT
A. I. Rudev and V. S. Vereshchetin 29 Mar. 1974 20 p refs Transl. into ENGLISH from Sovetskoye Gosudarstvo i Pravo (Moscow), no.'s 1 and 4, 1972 p 111-115, 121-124
(JPRS-61614) Avail: NTIS HC $4.00

An examination is presented of international cooperation and law on manned spaceflight, and on environmental studies from space. For individual titles, see N74-19486 through N74-19487.

N74-19486 Joint Publications Research Service, Arlington, Va.
MANNED SPACE STATIONS IN CIRCUMTERRESTRIAL ORBITS
A. I. Rudev and V. G. Emin *In its* Legal Aspects of Manned Spaceflight and Remote Sensing of the Environment (JPRS-61614) 29 Mar. 1974 p 1-10 refs Transl. into ENGLISH from Sovetskoye Gosudarsto i Pravo (Moscow), no. 4 p 111-115 (For availability see N74-19485 10-30)

International laws for space activities in manned earth orbital missions are discussed. Regulatory measures already taken by the U.N. are reviewed. The following suggestions are made for areas in which future regulations may be required: (1) measures to insure the fair distribution of information from earth resources flights to all nations; (2) assignment of safe orbits for launching, and special distribution of geostationary orbits; (3) international registry of all spacecraft; (4) control of radiation safety hazards, especially with regards to nuclear rocket engines; (5) systems for the removal of rubbish from space; and (6) measures to provide for international cooperation in astronaut rescue operations, such as having stationary rescue vehicles with standard apparatus for approach and docking. S.K.W.

N74-19487 Joint Publications Research Service, Arlington, Va.
ENVIRONMENTAL STUDIES FROM SPACE
V. S. Vereshchetin *In its* Legal Aspects of Manned Spaceflight and Remote Sensing of the Environment (JPRS-61614) 29 Mar. 1974 p 11-19 refs Transl. into ENGLISH from Sovetskoye Gosudarsto i Pravo (Moscow), no. 1 p 121-124 (For availability see N74-19485 10-30)

The regulation of environmental information from remote sensing spacecraft is discussed in terms of the sovereign rights of nations. It is recommended that commercial use of this data not be permitted without a country's knowledge and consent.
S.K.W.

N74-19488# Joint Publications Research Service, Arlington, Va.
CHEMICAL COMPOSITION OF THE LUNAR SURFACE IN THE LUNOKHOD-2 WORK REGION
G. Ye. Kocharov and S. V. Viktorov 29 Mar. 1974 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 214, no. 1, 1974 p 71-74
(JPRS-61608) Avail: NTIS HC $4.00

A discussion of the chemical composition of the lunar surface in the work region of the Soviet Lunokhod-2 lunar roving vehicle is presented. Author

N74-19489# Committee on Science and Astronautics (U. S. House).
SPACE SHUTTLE, SPACE TUG, APOLLO-SOYUZ TEST PROJECT - 1974 Status Report
Washington GPO Feb. 1974 789 p Presented to Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., 1 Mar. 1974
Avail: Subcomm. on Manned Space Flight

A Congressional hearing on the space shuttle, space tug, and Apollo-Soyuz project was conducted. The information was provided by the NASA Manned Space Flight Centers and key industrial contractors involved in the three programs. A review of the cost, performance, and schedules of the three programs is presented. Photographs and maps of the launch facilities and support complexes are included. Illustrations of the various space shuttle concepts, and configurations are shown. P.N.F.

N74-19490*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SKYLAB MISSION REPORT, SECOND VISIT
Jan. 1974 336 p refs
(NASA-TM-X-69996; JSC-08662) Avail: NTIS HC $20.00 CSCL 22C

An evaluation is presented of the operational and engineering aspects of the second Skylab flight. Other areas described include: the performance of experimental hardware; the crew's evaluation of the flight; medical aspects; and hardware anomalies. Author

N74-19491+ Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
A PROPOSAL FOR THE STUDY OF SOLAR ATMOSPHERE AND A DESIGN OF THE TELESCOPE
K. Ramanuja Rao Jul. 1972 50 p
(INPE-206-RI/007) Avail: NTIS HC $5.50

The fine structural features of photosphere and chromosphere and the interaction between them are discussed in detail, and the importance of their study to understand the solar phenomena is delineated. A study of some of these features using cinemetographic and other methods is proposed. The detailed designs of three telescopes, (1) to observe the photosphere in high resolution mode and (2) to observe chromosphere in patrol and high resolution modes, are given. The specifications for the construction of these telescopes are given in appendices. Author

N74-19492# Joint Publications Research Service, Arlington, Va.
THE EARTH'S OZONE SHIELD
Aleksandr Khristoforovich Khrgian 4 Mar. 1974 13 p Transl. into ENGLISH from Priroda (Moscow), no. 11, Nov. 1973 p 22-27
(JPRS-61377) Avail: NTIS HC $4.00

A study is presented of the ozone shield as part of the global problem of environmental conservation. Author

N74-19493# Joint Publications Research Service, Arlington, Va.
THROUGH THE ATMOSPHERES OF THE PLANETS
A. Serov 28 Feb. 1974 11 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 4, 1973 p 34-35, 37
(JPRS-61355) Avail: NTIS HC $4.00

The role of atmospheric parameters such as density in the design of automatic interplanetary space stations is discussed. Soft landing of descent modules on Venus and Mars is emphasized. Topics discussed include acceleration, aerodynamic braking, thermal shielding, dynamic stability, trajectories, test procedures, and roving vehicles. S.K.W.

N74-19494*# Techtran Corp., Glen Burnie, Md.
THERMAL REGIME AND CONVECTIVE MOTIONS IN THE LOWER LAYERS OF THE VENUSIAN ATMOSPHERE
V. S. Avduyevskiy, F. S. Zavelevich, M. Ya. Marov, A. I. Noykina, and V. I. Polezhayev Washington NASA Mar. 1974 11 p refs Transl. into ENGLISH from the book "Fizika Luny i Planet" Moscow, Nauka Press, 1972 p 383-388
(Contract NASw-2485)
(NASA-TT-F-15430) Avail: NTIS HC $4.00 CSCL 03B

The transfer of radiation in a flat layer of gas, in the infrared where the surface spectral brightness of Venus is maximum and where the major CO2 and H2O absorption bands exist, is analyzed. The gas is assumed to be transparent in the visible, far-ultraviolet and near-infrared bands of the solar spectrum, and the curvature of the surface layer of the atmosphere is considered negligible. Author

N74-19495*# Kanner (Leo) Associates, Redwood City, Calif.
FROM HYPOTHESIS TO FACT: THE EARTH-MARS EXPERIMENT
Ye. Kodin and D. Pipko Washington NASA Mar. 1974 8 p Transl. into ENGLISH from Sots. Industriya (USSR), 17 Mar. 1974 p 3
(Contract NASw-2481)
(NASA-TT-F-15456) Avail: NTIS HC $4.00 CSCL 22A

The problems involved in a descent trajectory on Mars by the U.S.S.R. Mars 6 automatic spacecraft are discussed. Atmospheric conditions and possible water supplies on Mars are considered, and photographs of surface craters are included. K.M.M.

N74-19496# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 319
1 Mar. 1974 49 p Transl. into ENGLISH from Russian reports
(JPRS-61360) Avail: NTIS HC $5.50

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Author

N74-19497*# National Aeronautics and Space Administration, Washington, D.C.
SOYUZ 13: THE STARS, THE EARTH AND WEIGHTLESSNESS
M. Vasilyev Mar. 1974 5 p Transl. into ENGLISH from Izvestiya (USSR), 21 Feb. 1974 p 5
(NASA-TT-F-15457) Avail: NTIS HC $4.00 CSCL 03B

Brief summaries of research activities during the flight of Soyuz 13 are presented. Topics discussed include spectral photography of the stars and earth, the effect of weightlessness on the blood distribution in the body and on the growth of bacteria. S.K.W.

N74-19498*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
SPECTRAL STUDY OF SUGGESTED APOLLO SITES Final Report
Thomas McCord [1973] 194 p refs
(Grant NGR-22-009-496)
(NASA-CR-137240; DSR-72406) Avail: NTIS HC $12.75 CSCL 03B

The spectrophotometry (0.3 to 1.1 microns) of visited and proposed Apollo landing sites is presented along with proposals for financial support of the spectral study. The electronic spectra of pyroxenes is investigated along with an interpretation of telescopic spectral reflectivity curves of the moon. Reprints of published articles related to these studies are included. K.M.M.

N74-19499*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
PARTICIPATION IN THE APOLLO PASSIVE SEISMIC EXPERIMENT Final Report
Frank Press, M. Nafi Toksoez, and Anton Dainty 3 Jul. 1972 67 p refs
(Grant NGR-22-009-123)

(NASA-CR-137239) Avail: NTIS HC $6.50 CSCL 03B

Computer programs which were written to read digital tapes containing lunar seismic data were studied. Interpreting very early parts of the lunar seismogram as seismic body-wave phases enabled the determination of the structure of the outer part of the moon in the Fra Mauro region. The crust in the Fra Mauro region is 60 to 65 km-thick, overlaying a high velocity mantle. The crust is further divided into an upper part, 25 km thick, apparently made of material similar to the surficial basalts, and a lower part of seemingly different composition, possibly an anorthositic gabbro. The generation of the exceedingly long reverberating wave-train observed in lunar seismogram was also studied. This is believed to be due to an intense scattering layer with very high quality coefficient overlying a more homogeneous elastic medium. Titles and abstracts of related published papers are included. Author

N74-19500*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE CHARACTERISTICS OF A POSSIBLE LOW ALTITUDE ELECTRON LAYER IN THE MARTIAN ATMOSPHERE M.S. Thesis - George Washington Univ.

Herbert Andrew Wallio Dec. 1973 82 p refs

(NASA-TM-X-69962) Avail: NTIS HC $7.25 CSCL 03B

The apparent diurnal Martian surface pressure variation, as deduced from radio occultation experiments, is discussed and explained as possibly arising from the effect of a low altitude electron layer. Possible source and loss mechanisms for the low altitude electron layer are presented and discussed. Time-dependent differential equations describing the electron layer are derived and then integrated to investigate the electron distribution resulting from the several processes that might occur in the atmosphere. It is concluded that the source mechanism is the sublimation of alkali atoms from a permanent dust layer (a dust layer of 0.2 micron particles of density 9/cu cm is sufficient), and that the dominant loss process must involve CO2 clustering to the alkali atoms. Using these processes, an electron layer is developed which would explain the apparent diurnal surface pressure. Author

N74-19501*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ESTIMATION STRATEGIES FOR ORBIT DETERMINATION OF APPLICATIONS SATELLITES

P. Argentiero and J. J. Lynn Feb. 1974 27 p refs

(NASA-TM-X-70610; X-932-74-43) Avail: NTIS HC $4.50 CSCL 22C

A procedure for applying covariance analysis to determine the most efficient estimation strategy for satisfying the stringent mission requirements of long arc orbit determination of applications satellites is presented. The procedure is applied to the problem of satisfying mission requirements with respect to altitude determination of GEOS-C. It is shown that requirements are met when twelve dominant geopotential coefficients are estimated along with satellite state. This application of covariance analysis is general and can be applied to future applications satellites. Recommendations for future studies are also given. Author

N74-19502# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 392

4 Mar. 1974 18 p refs Transl. into ENGLISH from various Eastern European publications

(JPRS-61386) Avail: NTIS HC $4.00

Articles concerning the development of and progress in the various theoretical and applied scientific disciplines and technical fields; and the administration, structure, personnel, and research plans of East European scientific organizations and institutions, particularly the academies of sciences are presented. Specific topics discussed are satellite communications, the synthesis of protein from fat, tuberculosis research, and development in geodesy. Author

N74-19503# Osservatorio Astronomico, Rome (Italy).

SOLAR PHENOMENA Monthly Bulletin, Oct. 1973

Massimo Cimino Oct. 1973 10 p

(Publ-186) Avail: NTIS HC $4.00

Solar data for October 1973 are presented. Tables include: daily total areas of sunspot groups; heliographic position, classification, and area of sunspot groups; longitudinal sunspot magnetic fields; and hours of k-line cinematographic patrol. ESRO

N74-19504# Osservatorio Astronomico, Rome (Italy).

SOLAR PHENOMENA Monthly Bulletin, Nov. 1973

Massimo Cimino Nov. 1973 10 p

(Publ-187) Avail: NTIS HC $4.00

Solar data for November 1973 are presented. Tables include: daily total areas of sunspot groups; heliographic position, classification, and area of sunspot groups; longitudinal sunspot magnetic fields; and hours of K-line cinematographic patrol. ESRO

N74-19505# Naval Weapons Lab., Dahlgren, Va. 22/3

ORBITAL ACCURACY SIMULATION PROGRAM

Marshall B. Faintich Aug. 1973 52 p ref

(AD-772524; NWL-TR-3079) Avail: NTIS

The report describes a computer program that estimates the accuracy of ephemeris determination based on various tracking station configurations. The user may specify any satellite orbital elements and up to one hundred tracking stations. Some approximations used in this version of the program yield more accurate results for nearly circular, low or moderate altitude orbits. In addition, the user may specify particular portions of the earth over which the ground track passes in order to determine mission accuracies over these areas only. The program estimates ephemeral accuracies, based on either ascending or descending nodal crossings, for the entire station net, as well as for missions with the removal of any station or pairs of stations. The program is a useful tool for the optimization of a tracking station network for a particular satellite orbit. Author (GRA)

N74-19506# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

ENERGETIC ELECTRONS IN THE MAGNETOSPHERE OF JUPITER

J. A. VanAllen, D. N. Baker, B. A. Randall, M. F. Thomsen, D. C. Sentman, and H. R. Flindt 20 Dec. 1973 20 p refs Revised

(Contracts N00014-68-A-0196-0003; N00014-68-A-0196-0009)

(AD-772080; U-of-Iowa-73-41-Rev) Avail: NTIS CSCL 03/2

The report discusses preliminary results of in situ observations of energetic electrons in the magnetosphere of Jupiter during the Pioneer 10 encounter 26 November - 11 December 1973. GRA

N74-19507# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.

SPECTROMETER FOR FAR INFRARED ASTRONOMY Final Report, 1 May 1971 - 30 Apr. 1973

Martin Harwit May 1973 47 p refs

(Contract F19628-71-C-0183)

(AD-772825; CRSR-547; AFCRL-TR-73-0517) Avail: NTIS CSCL 03/2

The doubly encoded Hadamard Transform Spectrometer which has a 509 x 255 slots configuration was constructed and tested. A spectral resolution of 1000 was demonstrated in various experimental conditions in laboratory and some results are shown in the report. Then the instrument was brought at Kitt Peak National Observatory and used to obtain some astronomical data. A preliminary test was also conducted for the airborne operation of the instrument. Author (GRA)

N74-18755* National Aeronautics and Space Administration, Washington, D.C.

THE SPACE STATION: KEY TO LIVING IN SPACE

Douglas R. Lord *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 3-11 (For availability see N74-18754 10-04)

CSCL 22A

N74-18759* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPACE STATION CAPABILITY FOR RESEARCH IN

ROTATIONAL HYPOGRAVITY
George Keller *In its* Fifth Symp. on the Role of the Vestibular Organs in Space Exploration 1973 p 43-53 refs (For availability see N74-18754 10-04)
CSCL 22A

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N74-19508 Washington Univ., Seattle.
STABILITY OF ULTIMATE MOTION IN AN ATTITUDE CONTROL SYSTEM HAVING UNSYMMETRICAL TORQUERS Ph.D. Thesis
Harold Arne Kolve 1973 214 p
Avail: Univ. Microfilms Order No. 74-814

An analysis is presented of a satellite attitude control system which incorporates an integral pulse frequency modulator. This type of modulator emits a standard pulse if and when the integral of the control signal changes by a preset amount. However the strength of the positive control pulse and negative control pulse are substantially different. Results are established in terms of the physical parameters of the system for both the small signal ultimate state motion and the large signal convergence. To investigate the large signal convergence, a function, referred to as the convergence function, is used as an analytical tool. This convergence function is similar to a Liapunov function, but involves the concept of distance to a set and discrete time variables. The convergence properties of the system are established by use of the convergence function and the geometrical properties of the solution of the difference equations. The analytical results are corroborated by computer simulation. Dissert. Abstr.

N74-19509 Colorado Univ., Boulder.
THE LONGITUDINAL DYNAMICS OF A VEHICLE ORBITING WITHIN THE EARTH'S ATMOSPHERE Ph.D. Thesis
Arthur John Dobrzelecki 1973 233 p
Avail: Univ. Microfilms Order No. 73-32529

The longitudinal dynamics of a thrusting, lifting vehicle traveling in a nearly circular orbit within the earth's atmosphere was studied. The vehicle motion consists of two damped oscillatory modes, phugoid and pitching, and a spiral mode which results in a decay or a dilation of the orbit depending upon the perturbed initial conditions. Approximate analytical solutions to the linearized equations of motion were derived which are in excellent agreement with numerical solutions of the exact equations of motion for small initial perturbations. Nonlinear effects were investigated. Nearly all nonlinear effects can be attributed to nonlinear atmospheric density terms in the equations of motion. Neglect of these terms can result in significant errors in the prediction of the vehicle motion. It is shown that near the altitude where the linear oscillatory mode frequencies are equal, the linearized solution for the pitching mode may not be valid even for small initial perturbations. Dissert. Abstr.

N74-19510 Colorado Univ., Boulder.
DETERMINATION OF OPTIMAL INITIAL CONDITIONS FOR AN ORBITAL LAUNCH FACILITY Ph.D. Thesis
Jerry Neill Mason 1973 144 p
Avail: Univ. Microfilms Order No. 73-32565

A launch facility in a circular 250 nautical mile orbit was selected with an interplanetary injection stage capability of 13,000 feet per second. The orbit once established was allowed to change due to the perturbing action of the earth's oblateness. A comprehensive study of the two launch windows for Mars and the four launch windows for Venus which occur in the 1980 to 1985 time period has shown that at least one coplanar launch opportunity can be guaranteed for any initial orientation for all six launch windows in the range of inclination between 23.44 and 60 degrees. It was also shown that the equation determining the times at which coplanar opportunities occur was empirically linear with initial orientation. A set of design curves were developed for use in selecting initial launch facility orbits for varying mission sets. Dissert. Abstr.

N74-19511+ Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
VHF POLARIMETRY USING GEOSTATIONARY SATELLITE SIGNALS
N. D. Kaushika Nov. 1972 12 p refs
(INPE-262-RI/051) Avail: NTIS HC $4.00

The objective of the setting up of a VHF polarimeter using the geostationary satellite signals which cross the ionospheric regions controlled by the Appleton ionospheric anomaly as well as by the rotational geomagnetic field phenomena is described. The qualitative description of the preliminary recordings is also given. Author

N74-19512*# Bendix Corp., Teterboro, N.J. Navigation and Control Div.
ADVANCED C AND D TECHNIQUES AND APPLICATION STUDY Final Report
Kenneth Kendall and Carlo Coscia May 1973 126 p
(Contract NAS8-28657)
(NASA-CR-124441) Avail: NTIS HC $9.50 CSCL 22B

A study was conducted to identify a broad base of payload control and display requirements for space missions. The subjects discussed are: (1) functional requirements and allocation analysis, (2) control and display generic device matrix, (3) control functional requirements, and (4) display functional requirements. Specific applications of payload control and display requirements for various disciplines are defined. Author

N74-19513*# Chrysler Corp., New Orleans, La. Space Div.
EXPERIMENTAL INVESTIGATIONS OF AN 0.0405 SCALE SPACE SHUTTLE CONFIGURATION 3 ORBITER TO DETERMINE SUBSONIC STABILITY CHARACTERISTICS (OA21A/OA21B), VOLUME 2
B. W. Cameron (Rockwell International, Los Angeles) and A. J. Ritschel (Rockwell International, Los Angeles) Jan. 1974 427 p
(Contract NAS9-13247)
(NASA-CR-128792; DMS-DR-2053-Vol-2) Avail: NTIS HC $24.50 CSCL 22B

Aerodynamic investigations were conducted in a low speed wind tunnel from June 18 through June 25, 1973 on a 0.0405 scale -139B model Space Shuttle Vehicle orbiter. The purpose of the test was to investigate the longitudinal and lateral-directional subsonic aerodynamic characteristics of the proposed PRR Space Shuttle Orbiter. Emphasis was placed on component buildup effects, elevon, rudder, body flaps, rudder flare effectiveness, and canard and speed brake development. Angles of attack from -4 to 24 and angles of sideslip of -10 to 10 were tested. Static pressures were recorded on the base. The aerodynamic force balance results are presented in plotted and tabular form. Author

N74-19514*# Chrysler Corp., New Orleans, La. Data Management Services.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS ON AN 0.030-SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 13
R. H. Spangler (Rockwell Intern., Downey, Calif.) Feb. 1974 844 p refs 18 Vol.
(Contract NAS9-13247)
(NASA-CR-128794; DMS-DR-2032-Vol-13) Avail: NTIS HC $45.25 CSCL 22C

Tests were conducted in wind tunnels during April and May 1973, on a 0.030-scale replica of the Space Shuttle Vehicle Configuration 2A. Aerodynamic loads data were obtained at Mach numbers from 0.6 to 3.5. The investigation included tests on the integrated (launch) configuration and on the isolated orbiter (entry configuration). The integrated vehicle was tested at angles of attack and sideslip from -8 deg to +8 deg. The isolated orbiter was tested at angles of attack from -15 deg to +40 deg and angles of sideslip from -10 deg to +10 deg as dictated by trajectory considerations. The effects of orbiter/external tank incidence angle and deflected control surfaces on aerodynamic

loads were also investigated. Tabulated pressure data are given for the following components: orbiter fuselage and base; OMS and upper MPS nozzles; body flap; and OMS pod outside.
Author

N74-19515*# Bendix Corp., Denver, Colo. Navigation and Control Div.
STUDY TO DEFINE LOGIC ASSOCIATED WITH CMGS TO MANEUVER AND STABILIZE AN ORBITING SPACECRAFT
Final Report
4 Sep. 1973 528 p refs
(Contract NAS9-13085)
(NASA-CR-134207) Avail: NTIS HC $29.50 CSCL 22B

A study was conducted to define the logic associated with the control moment gyroscopes to maneuver and stabilize an orbiting spacecraft. The study objectives are as follows: (1) to define mission requirements and feasible attitudes for a shuttle-like vehicle that will meet mission objectives, (2) to determine the control moment gyroscope (CMG) and system configurations that will best meet overall mission requirements, (3) to define all of the software required to manage and control the selected CMG systems, and (4) to verify by computer simulation the adequacy of the selected CMG system and specified software package in meeting the overall mission requirements. Author

N74-19516*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: COMMAND AND SERVICE MODULE ELECTRICAL POWER DISTRIBUTION ON SUBSYSTEM
Robert E. Munford and Bob Hendrix Washington Mar. 1974 25 p
(NASA-TN-D-7609; JSC-S-386) Avail: NTIS HC $3.00 CSCL 22B

A review of the design philosophy and development of the Apollo command and service modules electrical power distribution subsystem, a brief history of the evolution of the total system, and some of the more significant components within the system are discussed. The electrical power distribution primarily consisted of individual control units, interconnecting units, and associated protective devices. Because each unit within the system operated more or less independently of other units, the discussion of the subsystem proceeds generally in descending order of complexity; the discussion begins with the total system, progresses to the individual units of the system, and concludes with the components within the units. Author

N74-19517*# Chrysler Corp., New Orleans, La. Space Div.
SUPERSONIC PERFORMANCE, STABILITY AND CONTROL CHARACTERISTICS OF A 0.01875 SCALE MODEL ROCKWELL INTERNATIONAL 089B-139B ORBITER CONFIGURATION (LA8C)
R. W. Powell (NASA. Lewis Res. Center) and G. M. Ware (NASA. Lewis Res. Center) Jan. 1974 74 p
(Contract NAS9-13247)
(NASA-CR-134080; DMS-DR-2090) Avail: NTIS HC $6.75 CSCL 22B

An investigation was made in the Langley Unitary Plan Wind Tunnel at Mach numbers of 1.9 and 2.86 to study the supersonic aerodynamic characteristics of a Rockwell International shuttle orbiter configuration. Tests were made at a Reynolds number of 1.5 million per foot with an angle-of-attack range of minus 4 to 28 deg and sideslip variations of minus 6 to 8 deg. The effects of elevon and aileron deflections were investigated. Author

N74-19518# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CRITERIA FOR THE ESTABLISHMENT OF THE LONGITUDE RANGE OF A BRAZILIAN DOMESTIC SATELLITE
Celso A. DeAzevedo Jun. 1972 54 p refs
(INPE-193-LAFE) Avail: NTIS HC $5.75

Some criteria is analyzed for the establishment of the longitude range in the geostationary orbit appropriate for the location of a Brazilian domestic satellite operating in the 2500 - 2690 MHz band. The analyzed criteria aim to protect the fixed service sharing the same band, to waste power over the Atlantic and Pacific Oceans, to concentrate as much power as possible over Brazil, and to reduce the effects of the satellite eclipse. The power flux density limitations on the earth's surface are analyzed and the maximum permissible satellite EIRP resulting from these limitations is calculated. The satellite longitude range, to have its eclipse between 01:00 to 04:00 a.m., is calculated. The resultant coverage contours on ground are studied as a function of the satellite longitude. Author

N74-19519*# North American Rockwell Corp., Downey, Calif. Space Div.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 2: SYSTEM ENGINEERING, PART 1, FINAL REPORT
Oct. 1972 154 p
(Contract NAS5-21705)
(NASA-CR-132947; SD-72-SA-0133-2) Avail: NTIS HC $10.75 CSCL 22B

All elements of the TDRS system were studied with emphasis on the design of a 3-axis stabilized satellite, and a telecommunication system optimized for support of low and medium data rate user spacecraft constrained to be launched on a Delta 2914. The research is reported to upgrade the spacecraft design to provide telecommunications support low, medium and high data rate users, considering launches with the Atlas/Centaur and the space shuttle. For Vols. 4, 5, 7, and 8, see N74-10809 through N74-10812. Author

N74-19520# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, OCTOBER 1973
R. D. Eberst 13 Nov. 1973 30 p
(ROE-STS-161) Avail: NTIS HC $4.50

Stopwatch observations made at stations during October 1973 are listed in satellite launch and time order: 521 fully reduced observations of 135 satellites. Author (ESRO)

N74-19521# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
HEWITT CAMERA OBSERVATIONS MADE AT EARLYPOINT ON VARIOUS SATELLITES FROM 1 OCTOBER 1971 TO 30 APRIL 1972
K. S. Russell 29 Nov. 1973 32 p ref
(ROE-STS-162) Avail: NTIS HC $4.75

Satellite observations made with a Hewitt camera at Earlyburn Outstation are listed in satellite launch and time order for each satellite for the period from 1 October 1971 to 30 April 1972. Fully reduced observations of 27 transits of 13 satellites are given. Author (ESRO)

N74-19522# Royal Aircraft Establishment, Farnborough (England).
PROSPERO: THE FIRST YEAR IN ORBIT
V. W. Adams Sep. 1973 31 p refs
(RAE-TR-73114; BR37104) Avail: NTIS HC $4.75

The orbital operations and overall behavior of the satellite Prospero (1971-3A) launched from Woomera on 28th October 1971 into an eccentric, near-polar orbit with a perigee height of 547 km, an apogee height of 1582 km, and an inclination of 82.06 deg is presented. The satellite orbit, attitude, spin, power supply system, and data systems are described. Experiments on thermal control surfaces, hybrid electronics, and micrometeoroid detection are detailed. It is concluded that Prospero has proved to be a very successful spacecraft, and experience gained is being used in studies for future satellites, particularly in formulating orbital operations. ESRO

N74-19523# Aerospace Corp., El Segundo, Calif.
THE LOW-G ACCELEROMETER CALIBRATION SYSTEM ORBITAL ACCELEROMETER EXPERIMENT. VOLUME 1: EXPERIMENT DESCRIPTION AND METHODOLOGY
Technical Report, Jun. 1966 - Jun. 1970
J. A. Pearson, R. W. Bruce, Y. T. Chiu, W. A. Feess, and E. G. Fotou 1 Jul. 1973 359 p refs
(Contract F04701-73-C-0074)
(AD-772717; TR-0074(4260-10)-1-Vol-1; SAMSO-TR-73-355-Vol-1) Avail: NTIS CSCL 22/2

The LOGACS (Low-G Accelerometer Calibration System) experiment, which contained a miniature electrostatic accelerome-

ter (Mesa), was placed in a low-altitude polar orbit on 22 May 1967. The experiment provided approximately 100 hours of acceleration data from which the accelerometer scale factor, accelerometer null bias, and atmospheric drag on the satellite were calculated. The mission description, the characteristics of the accelerometer, the instrumentation used in the experiment, and a summary of the results of the inflight accelerometer calibration are presented in this volume. The accelerometer's sensing environment is discussed, as are the data reduction methods used to extract the scale factor and bias of the accelerometer and the methods of determining the acceleration due to aerodynamic drag. Author (GRA)

N74-19524# Aerospace Corp., El Segundo, Calif.
THE LOW-G ACCELEROMETER CALIBRATION SYSTEM ORBITAL ACCELEROMETER EXPERIMENT. VOLUME 2: EXPERIMENT ANALYSES AND RESULTS Technical Report, Jun. 1966 - Jun. 1970
J. A. Pearson, R. W. Bruce, Y. T. Chiu, W. A. Feess, and E. G. Fotou 1 Jul. 1973 427 p refs
(Contract F04701-73-C-0074)
(AD-772718; TR-0074(4260-10)-1-Vol-2; SAMSO-TR-73-355-Vol-2) Avail: NTIS CSCL 22/2

The LOGACS (Low-G Accelerometer Calibration System) experiment, which contained a miniature electrostatic accelerometer (MESA), was placed in a low-altitude polar orbit on 22 May 1967. The experiment provided approximately 100 hours of acceleration data from which the accelerometer scale factor, accelerometer null bias, and atmospheric drag on the satellite were calculated. Extensive comparisons of the data to various model atmospheres are made. These analyses are the more interesting because of the intense solar and geomagnetic activity during the latter part of the LOGACS flight. From the data, both midlatitude and polar models of atmospheric density have been developed over altitudes for which LOGACS data were available. (Modified author abstract) GRA

N74-19525# ARO, Inc., Arnold Air Force Station, Tenn.
HEAT TRANSFER TESTS OF TWO SPACE SHUTTLE ORBITER CONFIGURATIONS AT MACH NUMBER 8 Final Report, 25 Aug. - 28 Sep. 1972
W. R. Martindale AEDC Jan. 1974 45 p refs
(AD-772687; ARO-VKF-TR-72-198; AEDC-TR-73-59) Avail: NTIS CSCL 22/2

Heat transfer tests were conducted on two space shuttle configurations at Mach number 8 to investigate the effects of nose geometry on windward and leeward heating and boundary layer transition. Free-stream Reynolds number based on model length was varied from 1.5 to 7.5 million at angles of attack from 20 to 50 deg. Windward centerline heating rates were in general agreement with calculated values except for laminar rates downstream of the wing/body junction. Differences in the location of the beginning of transition and the length of the transition zone were observed for the two configurations, but it was not clear whether variation in nose shape per se or the abrupt cross-sectional change from the nose to the aft fuselage and wing was the controlling factor. Author (GRA)

N74-19526# National Research Council of Canada, Ottawa (Ontario).
DYNAMIC STABILITY TESTING OF AIRCRAFT: NEEDS VERSUS CAPABILITIES
K. J. Orlik-Rueckemann 1973 17 p refs
(AD-773160) Avail: NTIS CSCL 22/2

The report presents highlights of a recent survey of the future needs for dynamic stability information for such aerospace vehicles as the space shuttle and advanced high performance military aircraft, indicating the importance of obtaining this information for high-angle-of-attack high-Reynolds-number conditions. A review of the wind-tunnel capabilities in North America for measuring dynamic stability derivatives, reveals an almost total lack of such capabilities for Mach numbers above 0.1 at angles of attack higher than 25 degrees. In addition, capabilities to obtain certain new cross-coupling derivatives and information on effects of the coning motion are almost completely lacking. (Modified author abstract) GRA

N74-19527# TRW Systems Group, Redondo Beach, Calif.
INTEGRATED RADIOISOTOPE CATALYTIC MONOPROPELLANT HYDRAZINE ENGINE Final Report, Mar. 1972 - Oct. 1973
Ronald A. Carlson Dec. 1973 188 p refs
(Contract F04611-72-C-0064)
(AD-773195; AFRPL-TR-73-115) Avail: NTIS CSCL 22/2

In the advanced technology program radioisotope heat sources were incorporated into an Integrated Radioisotope Catalytic Monopropellant Hydrazine Engine designed to maintain the catalyst bed above 200F in an earth orbiting space environment. The impact of ambient temperature starts is thus reduced without requiring additional electrical power. A limited development effort was conducted to upgrade a 5-pound thrust engine design originally developed during a TRW IR and D program. Iterations of the injector and headspace designs and variations to the catalyst bed were evaluated. Accelerated life testing of the selected design revealed a headscreen deformation problem and verified the design improvement incorporated to prevent recurrence. (Modified author abstract) GRA

N74-19450* National Research Council of Canada, Ottawa (Ontario).
SPECTROSCOPY OF PROJECT FIRE 1, APRIL 14, 1964
Peter M. Millman *In* NASA, Washington Evolutionary and Phys. Properties of Meteoroids 1973 p 161-167 refs (For availability see N74-19436 10-30)
CSCL 04A

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N74-19528* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANTI-BUCKLING FATIGUE TEST ASSEMBLY Patent
Fred E. Eichenbrenner and Leland A. Imig, inventors (to NASA) Issued 5 Mar. 1974 6 p Filed 30 Mar. 1972 Supersedes N72-27947 (10 - 18, p 2496)
(NASA-Case-LAR-10426-1; US-Patent-3,795,134; US-Patent-Appl-SN-239575; US-Patent-Class-73-15.6; US-Patent-Class-73-91) Avail: US Patent Office CSCL 20K

An antibuckling fatigue test assembly is described for holding a metal specimen which is subjected to compression and to rapid cyclical heating and cooling while permitting visual observation. In an illustrative embodiment of this invention, the anti-buckling fatigue test apparatus includes first and second guide members between which the metal specimen is disposed and held, a heating assembly comprising a suitable heating source such as a quartz lamp and a reflecting assembly directing the heat onto the specimen, and a cooling assembly for directing a suitable cooling fluid such as air onto the specimen. The guide members each have a passage to permit the heat to be directed onto the specimen. An opening is provided in the reflecting assembly to permit visual inspection of that region of the specimen adjacent to the opening onto which the heat is directed.
Official Gazette of the U.S. Patent Office

N74-19529 Northwestern Univ., Evanston, Ill.
A TREATMENT OF EXACT AND APPROXIMATE SOLUTIONS TO A DIFFERENCE EQUATION MODEL FOR REGULAR MULTISTORY PLANE FRAMES Ph.D. Thesis
Sukhum Sukapanpotharam 1973 176 p
Avail: Univ. Microfilms Order No. 73-30738

The exact and approximate analyses of braced and unbraced regular multistory plane frames subjected to static in-plane loadings by the application of difference equation model are presented. In the exact analysis, a separation of variable technique is utilized for the solution of the homogeneous form of the moment difference equation for these frames. The solutions for the frames subjected to lateral loads, uniform loads, checker-board loads and concentrated moments in semi-closed forms are

discussed in detail. For the approximate solution, the principle of minimum total potential energy is employed in the analysis. Particular attention is given to the study of laterally loaded multistory plane frames. The total potential energy of the frame system can be expressed in terms of joint displacements, i.e., joint rotations, lateral and vertical displacements. A small number of terms in series form for each displacement function can be intelligently assumed from an understanding of the solution of the governing difference equations and the physical character of the frames. Dissert. Abstr.

N74-19530 Iowa State Univ. of Science and Technology, Ames.
THE NONLINEAR PROPERTIES OF A VISCOELASTIC MATERIAL UNDER IMPACT LOADING Ph.D. Thesis
Chin-Tza Tang 1973 85 p
Avail: Univ. Microfilms Order No. 74-578

The mechanical properties of Hysol 8705, a low-modulus viscoelastic material, were investigated experimentally under impact and sinusoidal loadings. The experimental results revealed that the material under investigation was nonlinear and had extremely different mechanical properties under these two kinds of loadings. Empirical relationships between various important parameters which characterize the mechanical properties of the material were established. A nonlinear three-parameter solid type of mathematical model consisting of a spring and a Kelvin element in series was found to satisfactorily reproduce the experimental impact property data. Dissert. Abstr.

N74-19531 Johns Hopkins Univ., Baltimore, Md.
AN EXPERIMENTAL STUDY OF THE OUTER YIELD SURFACE AND OF THE INCREMENTAL RESPONSE FUNCTION IN THE TOTALLY PLASTIC REGION FOR ANNEALED POLYCRYSTALLINE ALUMINUM Ph.D. Thesis
Hahngue Moon 1973 86 p
Avail: Univ. Microfilms Order No. 73-28418

Experimental data from thin walled tubes of annealed polycrystalline aluminum subjected to combined tension-torsion loading paths are described. These data reveal that small preloading in one direction does not change the shape of the outer yield surface and the subsequent plastic deformation beyond it. When the preloading is large enough, the easy straining phenomenon is observed under reverse loading and reloading in the range of strain through which the specimen has passed. These data also reveal that the plastic deformation in the totally plastic region can be described in terms of a path independent loading function and incremental response functions according to which the component of the plastic strain increment is decomposed into two parts: one is due to the expansion of the loading surfaces and the other is due to the change of the corresponding stress component and vanishes when the directions of stress and strain vectors coincide. Dissert. Abstr.

N74-19532 Stevens Inst. of Tech., Hoboken, N.J.
FINITE ELEMENT ANALYSIS OF SANDWICH SHELLS Ph.D. Thesis
W. John Denkmann 1973 181 p
Avail: Univ. Microfilms Order No. 74-867

The finite element method is applied to the static analysis of thin orthotropic elastic multilayered shells exhibiting significant transverse shear deformations with emphasis on sandwich shells. These shells are assumed to be loaded by concentrated forces, normal pressures, and/or thermal loads. The shells are assumed to lie on a shell of revolution, but are not required to be axisymmetric. The equations for the finite element method are derived using the techniques of the Ritz method. This assures convergence to the exact solution in energy if certain conditions of displacement continuity and completeness of the displacement functions are satisfied. Stiffness matrices and load vectors for two general finite elements are derived. These elements are quadrilatoral and triangular in shape and are composed of four and three basic triangular finite elements respectively. The edges of the basic element are determined by linear relations of the nodal point coordinates. A digital computer program was written for the analysis of three-layer shells. Dissert. Abstr.

N74-19533 Stevens Inst. of Tech., Hoboken, N.J.
FINITE ELEMENT TECHNIQUES FOR THE DYNAMIC ANALYSIS OF UNSYMMETRICALLY LAMINATED PLATES Ph.D. Thesis
Peter Paul Dinyovszky 1973 405 p
Avail: Univ. Microfilms Order No. 74-868

The development of two displacement-type finite element techniques suitable for the dynamic analysis and design of unsymmetrically laminated plates is discussed. The plates may consist of an arbitrary number of anisotropic (with one plane of symmetry), orthotropic, and/or isotropic layers; each of which may have different thickness and orientation of its elastic axes. The two techniques, as developed here, are based on the assumptions used to derive a pair of two-dimensional linear theories governing the behavior of laminated plates. In the first technique, the assumption is made that the effect of shear deformation can be accounted for in a manner similar to that used by Mindlin for homogeneous isotropic plates (the Shear Deformation Theory element); while in the second the Kirchhoff assumption of nondeformable normals is made (the Classical Laminated Plate Theory element). The formulation of both techniques includes the effects of coupling, as well as the effects of coupled and rotary inertia. Dissert. Abstr.

N74-19534 University of Southern Calif., Los Angeles.
STABILITY OF HYPERBOLOIDAL SHELLS: AN EXPERIMENTAL AND ANALYTICAL INVESTIGATION Ph.D. Thesis
Daniel Richard Veronda 1973 229 p
Avail: Univ. Microfilms Order No. 73-31394

The results of an experimental investigation of the stability of hyperboloidal shells under axial compression, external pressure and combined internal and external pressure and axial compression are presented. Buckling loads are also given for lateral pressure tests of hyperboloids simply supported at the base and free at the top. The data obtained are compared with predicted results using a linear finite element stability analysis and a corresponding nonlinear analysis wherein the effects of geometric nonlinearities are included. Experimental buckling loads were in good agreement with linear theory predictions, and the geometric nonlinearities were found to have little effect on the calculated critical loads of the hyperboloids tested. The experimental results were also compared to date for cylindrical shells, and indicated that the critical axial loads were far lower than results for cylinders, but very close to predicted values; this implies a low sensitivity to geometric imperfections. Dissert. Abstr.

N74-19535 Duke Univ., Durham, N.C.
AN ALTERNATIVE FOR THE FINITE ELEMENT METHOD Ph.D. Thesis
Richard Alan Nay 1973 204 p
Avail: Univ. Microfilms Order No. 74-1151

An economical alternative to the finite element method is presented for the linear equilibrium analysis of Kirchoffion plate bending and the membrane and bending problem of general shells. The alternative method is compared analytically and by example to the finite element method. A digital computer program named FIDEMS has been written which implements the alternative technique. The alternative method minimizes the total potential energy function by using the Ritz procedure with best-fit finite difference computational molecules. The best-fit formulation of the finite difference coefficients allows the selection of completely random meshes for the structure discretization. The alternative procedure is fully documented and several numerical examples for plates and shells are given comparing the finite element method to the best-fit finite difference energy method proposed in this work. The results indicate that the alternative method is indeed an economical alternative to the finite element method for the linear equilibrium analysis of plates and shells.
Dissert. Abstr.

N74-19536 Notre Dame Univ., Ind.
DYNAMIC ANALYSIS OF CRACKED CYLINDRICAL SHELLS AND PLATES WITH HOLES Ph.D. Thesis
Robert Francis Hegarty 1973 184 p
Avail: Univ. Microfilms Order No. 74-55

The free vibrations of a thin elastic plate with a circular hole and the forced vibrations of a cracked cylindrical shell are studied. The natural frequencies of a square plate, either simply supported or clamped, with a central circular hole are found by the point-matching method. The results indicate that the

frequencies first decrease, then increase as the hole size increases. The hole size at which the frequency is a minimum is found to depend not only on the boundary conditions but also on Poisson's ratio. A two-fold mechanism of strain energy reduction and mass reduction is proposed to explain the numerical results, and this same mechanism is used to explain results of previous studies on the free vibrations of cracked plates and plates with holes. Dissert. Abstr.

N74-19537 Notre Dame Univ., Ind.
COMPARISON OF SOME FINITE ELEMENT MODELS FOR CIRCULAR CYLINDRICAL SHELLS Ph.D. Thesis
Varappatti Govindarajulu Pandarinathan 1973 156 p
Avail: Univ. Microfilms Order No. 74-68

The discretization errors in the finite element solution are studied in detail for some models (kinematical, statical and mixed) of the circular cylindrical shell under axisymmetric loading. Two cases of loading vis., sine and boundary loading are considered. The analogous beam of the shell is treated in the analyses. The shear deformability of the shell (or beam) is included. The analytical solutions for the discretized systems are found by extracting typical rows of the assembled matrix equation and forming the governing difference equations using difference operators. The solutions follow them from these equations and boundary conditions through the application of the calculus of difference equations. Errors are found by comparing these analytical solutions with the continuum solution. Dissert. Abstr.

N74-19538 Georgia Inst. of Tech., Atlanta.
ON THE DYNAMIC CHARACTERISTICS OF BEAMS, PLATES AND SHELLS Ph.D. Thesis
Esam Eldin Mahmoud Nassar 1973 162 p
Avail: Univ. Microfilms Order No. 74-234

The work lays the foundations for correlating the vibrational, flexing and buckling characteristics of elastically restrained column and plate structures. It demonstrates that potentially powerful methods for non-destructive evaluation of critical axial loads based upon vibrational characteristics are feasible. Extensive use is made of a rational function technique to develop simple approximate expressions for both the natural frequencies and mode shapes of uniform elastically restrained beams. Using a simplified energy solution the vibration of rectangular plates with unequal elastic rotational restraint on the several edges is treated. A simple explicit-relationship is developed. From this relationship numerical results are readily obtained and such results have been used in conjunction with the rational function approach to devise extremely simple general relationships for plates. Dissert. Abstr.

N74-19539 Cincinnati Univ., Ohio.
FINITE ELEMENT ANALYSIS OF PERIODIC STRUCTURES Ph.D. Thesis
John Troy Coomer 1973 170 p
Avail: Univ. Microfilms Order No. 74-96

A finite element analysis of periodic structures. The structure is modeled by an assemblage of two types of elements, ring elements and sector elements. Both elements are triangular in cross-section. The ring elements are used to model the axisymmetrical parts of the structure, and the sector elements are used to model the periodic parts. In this study the sector element is developed which permits modeling of nonaxisymmetrical but periodic structures. Again the temperature distribution, nodal circle forces and nodal circle displacements are expanded in Fourier series. In this case, however the orthogonality properties of the harmonic functions cannot be used due to the harmonic coupling through the sector element. The three-dimensional problem becomes a series of simultaneous coupled two-dimensional analyses. Dissert. Abstr.

N74-19540 Georgia Inst. of Tech., Atlanta.
THE INSTABILITY OF PARTIALLY RESTRAINED COLUMNS AND PLATES Ph.D. Thesis
Sopan N. Chaudhari 1973 138 p
Avail: Univ. Microfilms Order No. 74-230

Instability is one of the main issues in structural design. The behavior of a structural element in a destabilizing environment is highly dependent upon the restraints at its boundaries. In most cases the determination of the exact solution to such problems is neither practical nor possible. An approximate solution must be used. Rayleigh-Ritz is one of the processes commonly employed to obtain approximate eigenvalues. The choice of a suitable displacement function is the key to the successful use of Rayleigh-Ritz process for determining critical loads of structures. No systematic method for making the appropriate choice for elastically restrained columns and plates existed. In this dissertation, a systematic method of generating the displacement function from those which correspond to the several combinations of zero and infinite restraints is outlined. Dissert. Abstr.

N74-19541 Georgia Inst. of Tech., Atlanta.
STUDIES ON THE ELASTIC STABILITY OF BODIES Ph.D. Thesis
Mahender Kumar Singhal 1973 159 p
Avail: Univ. Microfilms Order No. 74-237

Experimental research was undertaken to develop a reliable yet simple nondestructive testing technique for thin cylindrical shells under axial compression. The basis of the method is the fact that the stiffness of a compression member, in a direction normal to the applied axial load, tends to zero as the critical condition is reached. This is true for columns, plates and shells. For columns, it has some quite interesting practical consequences. It is shown that the plot of stiffness versus axial compression for a column is a straight line and that these lines are a family of parallel lines for different boundary conditions. The product of the critical load and the stiffness of the column under no axial load is, therefore, constant. Consequently, it enables the accurate determination of the critical load from the knowledge of the stiffness of the column ascertained by nondestructive lateral load. Dissert. Abstr.

N74-19542*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.
FRACTURE CHARACTERISTICS OF STRUCTURAL AEROSPACE ALLOYS CONTAINING DEEP SURFACE FLAWS
J. N. Masters, W. D. Bixler, and R. W. Finger Dec. 1973 238 p refs
(Contract NAS3-14341)
(NASA-CR-134587; D180-17759-1) Avail: NTIS HC $15.00 CSCL 20K

Conditions controlling the growth and fracture of deep surface flaws in aerospace alloys were investigated. Static fracture tests were performed on 7075-T651 and 2219-T87 aluminum, and 6Al-4V STA titanium . Cyclic flaw growth tests were performed on the two latter alloys, and sustain load tests were performed on the titanium alloy. Both the cyclic and the sustain load tests were performed with and without a prior proof overload cycle to investigate possible growth retardation effects. Variables included in all test series were thickness, flaw depth-to-thickness ratio, and flaw shape. Results were analyzed and compared with previously developed data to determine the limits of applicability of available modified linear elastic fracture solutions. Author

N74-19543*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.
THIN-METAL LINED PRD 49-III COMPOSITE VESSELS Final Report
J. T. Hoggatt Jan. 1974 134 p refs
(Contract NAS3-15840)
(NASA-CR-134555; ASG-2-5540) Avail: NTIS HC $9.75 CSCL 13D

Filament wound pressure vessels of various configurations were evaluated for burst strength and fatigue performance. The dimensions and characteristics of the vessels are described. The types of tests conducted are explained. It was determined that all vessels leaked in a relatively few cycles (20 to 60 cycles) with failure occurring in all cases in the metallic liner. The thin liner would de-bond from the composite and buckling took place during depressurization. No composite failures or indications of impeding composite failures were obtained in the metal-lined vessels. Author

N74-19544*# Boeing Aerospace Co., Seattle, Wash.
CYCLIC-STRESS ANALYSIS OF NOTCHES FOR SUPERSONIC TRANSPORT CONDITIONS
Feb. 1974 51 p refs
(Contract NAS1-12484)
(NASA-CR-132387) Avail: NTIS HC $5.75 CSCL 20K

The feasibility of using the finite element method to account for the effects of cyclic load and temperature on local stresses and strains at a notch was demonstrated. The behavior of a notched titanium panel was studied under variable loads and temperatures representative of flight conditions for the lower wing surface of a Supersonic Transport (SST). The analysis was performed with the use of the BOPACE finite-element computer program which provides capability to determine high temperature and large viscoplastic effects caused by cyclic thermal and mechanical loads. The analysis involves the development of the finite-element model as well as determination of the structural behavior of the notched panel. Results are presented for twelve SST flights comprised of five different load-temperature cycles. The results show the approach is feasible, but material response to cyclic loads, temperatures, and hold times requires improved understanding to allow proper modeling of the material. Author

N74-19545*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NEW TRIANGULAR AND QUADRILATERAL PLATE-BENDING FINITE ELEMENTS
R. Narayanaswami Washington Apr. 1974 74 p refs
(NASA-TN-D-7407; L-9180) Avail: NTIS HC $3.75 CSCL 20K

A nonconforming plate-bending finite element of triangular shape and associated quadrilateral elements are developed. The transverse displacement is approximated within the element by a quintic polynomial. The formulation takes into account the effects of transverse shear deformation. Results of the static and dynamic analysis of a square plate, with edges simply supported or clamped, are compared with exact solutions. Good accuracy is obtained in all calculations. Author

N74-19546# Cambridge Univ. (England). Dept. of Engineering.
A THEORY FOR FATIQUE FAILURE UNDER MULTIAXIAL STRESS-STRAIN CONDITIONS
M. W. Brown and K. J. Miller [1973] 42 p refs Submitted for publication
(CUED/C-Mat/TR-5) Avail: NTIS HC $5.25

A theory for multiaxial fatigue failure is presented. The theory is based on a physical interpretation of the mechanisms of fatigue crack growth. The theory is represented graphically by contours of constant life and a mathematical model of the strain relationships is developed. The theory is compared with several classical theories. The physical basis of the theory and its applicability to the full range of fatigue endurances are stressed. Author

N74-19547# Cambridge Univ. (England). Dept. of Engineering.
AN ELASTIC-PLASTIC FINITE ELEMENT ANALYSIS OF CRACK TIP FIELDS UNDER BIAXIAL LOADING CONDITIONS
K. J. Miller and A. P. Kfouri 1973 31 p refs
(CUED/C-Mat/TR-7) Avail: NTIS HC $4.75

A square plate containing a central crack and subjected to biaxial stresses was studied by a finite element analysis. An elastic analysis shows that the crack opening displacement and stress of separation ahead of the crack tip are not affected by the mode of biaxial loading and therefore the stress intensity factor adequately describes the crack tip states in an elastic continuum. An elastic-plastic analysis involving more than localized yielding at the crack tip provides different solutions of crack tip stress fields and crack face displacements for the different modes of biaxial loading. The equi-biaxial loading mode causes the greatest separation stress but the smallest plastic shear ear and crack displacement. The shear loading system induces the maximum size of shear ear and crack displacement but the smallest value of crack tip separation stress. Author

N74-19548*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A STABILITY ANALYSIS OF CYLINDRICAL PANELS USING A FINITE ELEMENT FORMULATION Ph.D. Thesis - Va. Polytechnic Inst. and State Univ.
Richard E. Snyder May 1971 135 p refs
(NASA-TM-X-69998) Avail: NTIS HC $9.75 CSCL 20K

A cylindrical finite element suitable for the linear stability analysis of cylindrical shells is developed. Energy principles and variational methods lead to a problem formulation which lends itself to physical interpretations of the governing matrices of the finite element. By properly grouping the terms which result from taking the second variation of the potential energy of the element, it is possible to identify three distinct types of matrices. The first matrix is the conventional stiffness matrix; the second is an initial stress stiffness matrix; and the third is an initial displacement stiffness matrix. With the assumption of linearity, the buckling problem is stated in terms of the classical linear real eigenvalue equation. This problem formulation was programmed on the CDC 6600 series computer. The computer program is used to analyze the buckling of a variety of structures. Columns, arches, flat plates and curved panels with and without cutouts are considered. Author

N74-19549*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELAS: A GENERAL-PURPOSE COMPUTER PROGRAM FOR THE EQUILIBRIUM PROBLEMS OF LINEAR STRUCTURES. VOLUME 2: DOCUMENTATION OF THE PROGRAM
Senol Utku 15 Oct. 1969 175 p refs
(Contract NAS7-100)
(NASA-CR-137236; JPL-TR-32-1240-Vol-2-Add) Avail: NTIS HC $11.75

A general purpose digital computer program for the in-core solution of linear equilibrium problems of structural mechanics is documented. The program requires minimum input for the description of the problem. The solution is obtained by means of the displacement method and the finite element technique. Almost any geometry and structure may be handled because of the availability of linear, triangular, quadrilateral, tetrahedral, hexahedral, conical, triangular torus, and quadrilateral torus elements. The assumption of piecewise linear deflection distribution insures monotonic convergence of the deflections from the stiffer side with decreasing mesh size. The stresses are provided by the best-fit strain tensors in the least squares at the mesh points where the deflections are given. The selection of local coordinate systems whenever necessary is automatic. The core memory is used by means of dynamic memory allocation, an optional mesh-point relabelling scheme and imposition of the boundary conditions during the assembly time. Author

N74-19550# Advisory Group for Aerospace Research and Development, Paris (France).
ACOUSTIC FATIGUE DESIGN DATA, PART 3
A. G. R. Thomson (Eng. Sci. Data Unit Ltd.) and R. F. Lambert (Eng. Sci. Data Unit Ltd.) Dec. 1973 62 p refs
(AGARDograph-162-Pt-3; AGARD-AG-162-Pt-3) Avail: NTIS HC $6.25

The design criteria for aircraft structural elements to reduce the effects of acoustic fatigue are discussed. The subjects presented are: (1) endurance of titanium and titanium alloy structural elements subjected to simulated acoustic loading, (2) damping in acoustically excited structures, (3) reference frequency of panel with flexible stiffeners, and (4) estimation of stress in skin panels with flexible stiffeners subjected to random acoustic loading. Author

N74-19551# Cambridge Univ. (England). Dept. of Engineering.
COMPRESSIVE TESTS ON PLATES WITH TRANSVERSE WELDS
G. H. Little and J. B. Dwight 1972 90 p refs
(CUED/C-Struct/TR-31) Avail: NTIS HC $7.50

Tests designed to investigate the effect of transverse welds on the compressive strength of unstiffened plating are reported. Two types were tested: fillet welds to cross-frames, and butt welds between equal-thickness plates. The specimens, thirty-four in all, were in the form of square stocky box columns in steel plate to grade 50B, of approximately 8 mm thickness, with b/t ranging from 29 to 57. The cusp and step distortions at the transverse weld were to a certain extent controlled during manufacture of the specimens. Many of the specimens failed in regions remote from the transverse welds, and enabled the effect of imperfections on basic plate strength to be studied. Author

N74-19552# Cambridge Univ. (England). Dept. of Engineering.
STIFFENED PLATING: A NEWMARK-MOXHAM THEORETICAL METHOD. COMPARISON WITH FAULKNER'S TESTS
G. H. Little Apr. 1972 11 p refs
(CUED/C-Struct/TR-27) Avail: NTIS HC $4.00

The stiffened plating which might form the compression flange of a box girder bridge is discussed. A longitudinally stiffened panel, subjected to endlong compression, is treated as a pin-ended column buckling between transverse stiffeners. It is assumed that the plating is wide enough, in relation to the spacing between transverse stiffeners, for orthotropic plate action of the whole compression flange to be neglected. The initial column imperfection causes the plate to receive the greater compressive strain in the cross section when under load. The problem is one of the interaction between local buckling of the plate between stiffeners and flexural buckling of the plate-stiffener assembly. The method of solution consists of employing Newmark's interative column treatment, in conjunction with an average stress-strain curve for the plate buckling taken from Moxham's theoretical work. Author

N74-19553*# Structural Composites Industries, Inc., Azusa, Calif.
EVALUATION OF POLYIMIDE/GLASS FIBER COMPOSITES FOR CONSTRUCTION OF LIGHT WEIGHT PRESSURE VESSELS FOR CRYOGENIC PROPELLANTS
I. Petker and M. Segimoto Sep. 1972 140 p
(Contract NAS3-15551)
(NASA-CR-121139; SCI-7322) Avail: NTIS HC $10.00 CSCL 13D

The application of polyimide resin as a matrix for glass filament-wound thin metal-lined pressure vessels was studied over a temperature range of minus 320 to 600 F. Keramid 601 polyimide was found to perform quite well over the entire range of temperature. Hoop stress values of 425 ksi were determined at 75 F which is equivalent to epoxy resin in similar structures. At minus 320 and 600 F, 125 and 80% of this strength was retained. Thermal aging at 500 F for up to 50 hours was studied with severe reduction in strength, but there is evidence that this reduction could be improved. Another polyimide resin studied was P10PA which was found to have processing characteristics inappropriate for filament-winding. NOL ring tensile and shear data was determined from both resins with S-glass. Pressure vessel design, fabrication and test procedures are described. Author

N74-19554# City Univ., London (England). Dept. of Mechanical Engineering.
CUMULATIVE DAMAGE IN FATIGUE UNDER MULTIAXIAL STRESS CONDITIONS
D. L. McDiarmid Jan. 1973 42 p refs
(ML-55) Avail: NTIS HC $5.25

Previous investigations into cumulative damage fatigue under uniaxial stress are discussed. The results of two level block program tests on 2L65 aluminum alloy at four values of constant principal stress ratio and at several combinations of two different principal stress ratios are presented and discussed with reference to cumulative damage theories developed for the case of uniaxial fatigue stress. An approach to the analysis of fatigue under nonconstant amplitude multiaxial stress is suggested. Author

N74-19555# City Univ., London (England). Dept. of Mechanical Engineering.
A CRITERION OF FATIGUE FAILURE UNDER MULTIAXIAL STRESS
D. L. McDiarmid Jan. 1973 59 p refs
(ML-54) Avail: NTIS HC $6.00

Previous investigations into fatigue under multiaxial stress are discussed in conjunction with the parameters relevant to the experimental investigation. A biaxial fatigue machine is described which is capable of subjecting thin wall tubes to combinations of fluctuating internal pressure and either fluctuating longitudinal tension or compression covering the comple tension-tension and tension-compression quadrants. Constant amplitude fatigue tests have been carried out on thin wall aluminum alloy tubular specimens over the complete tension-tension and tension-compression quadrants. An equation for predicting the fatigue failure of ductile metals under multiaxial stress is proposed based on the maximum range of shear stress modified for the effects of the normal stress acting on the maximum shear stress plane and of the anisotropy. Author

N74-19556# City Univ., London (England). Dept. of Mechanical Engineering.
A NEW ANALYSIS OF FATIGUE UNDER COMBINED BENDING AND TWISTING
D. L. McDiarmid Jan. 1973 33 p refs
(ML-56) Avail: NTIS HC $4.75

Existing fatigue failure criteria under multiaxial stress as applied to the case of combined bending and twisting are discussed. An equation for predicting the fatigue behaviour of ductile materials under combined bending and twisting is proposed based on the maximum range of shear stress modified for the effects of the normal stress acting on the maximum shear stress plane. The effects of material anisotropy are also discussed. This equation, based on the physical effects described above, is shown to be in better agreement with all published data on fatigue under combined bending and twisting than the empirical Gough ellipse quadrant equation. Author

N74-19557# City Univ., London (England). Dept. of Mechanical Engineering.
A CRITICAL REVIEW OF FATIGUE UNDER MULTIAXIAL STRESS
D. L. McDiarmid Jan. 1973 36 p refs
(ML-57) Avail: NTIS HC $5.00

The results of fatigue data in the literature, under conditions of constant and non-constant stress amplitude, are discussed. These include tests under combined bending and twisting, thin wall cylinders under the combined effects of fluctuating internal pressure and fluctuating end load, and thick walled cylinders under pulsating internal pressure. The various fatigue failure criteria for conditions of multiaxial stress are examined. Author

N74-19558# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
FINITE ELEMENT VISCOELASTIC STRESS ANALYSIS STUDY USING THE GENERALIZED KELVIN SOLID MODEL
R. K. Spears 17 Oct. 1973 43 p refs
(Contract AT(29-2)-656)
(GEPP-111) Avail: NTIS HC $4.25

Both filled and unfilled polymers are used extensively in the construction of neutron generators. These materials are used for environmental protection, high-voltage hold-off and, in some cases, to carry high-intensity dynamic stress waves. Reliability requirements, requires knowledge of how polymerization shrinkage stresses, thermal expansion stresses, and operational stresses affect their performance. To incorporate the effect of stress relief, several references on the treatment of viscoelastic materials were examined. The initial method studied was taken from a paper by Zienkiewicz et al. The program was checked against a theoretical model consisting of uniaxial loading of a prismatic solid. The resulting answer given as equilibrium creep strain, differed by 25%. Author (NSA)

N74-19559# Scientific Translation Service, Ann Arbor, Mich.
EMPIRICAL LAWS AND ASSOCIATED THEORY ON FATIGUE CRACK GROWTH
H. Kitagawa [1973] 23 p refs Transl. into ENGLISH from Zairyo (Kyoto), v. 21, 1972 p 710-719 Prepared for ORNL Sponsored by AEC
(ORNL-tr-2714) Avail: NTIS HC $3.25

Laws and theory of empirical, semi-empirical, and dimensional analyses are discussed. Theory of work hardening and its accumulation, theory of slip in a fixed direction, models of cracking, and other theories are also included. NSA

N74-19560# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.
TESTS ON EXTRUSION TUBINGS AND PROPOSAL FOR DIMENSIONING LAWS [ESSAIS SUR TUBULURES EXTRUDEES ET PROPOSITION DE REGLES DE DIMENSIONNEMENT]

Joris Decock Oct. 1973 48 p refs In FRENCH Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-MT-83) Avail: NTIS HC $5.50

Test results of fatigue and stress measurements in extruded apertures of pressure vessels are reported. Six apertures were studied under static internal pressure. Three of these were fatigue tested until rupturing. The fatigue tests as well as stress measurements show that the peak strains are about 15% lower than in conventional straight apertures. A dimensional analysis is proposed based on experimental results. A comparison was made with existing norms and experimental results and data show that only the power piping norm (USAS B 31.1.0) is adequate. ESRO

N74-19561# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.
A FINITE ELEMENT ANALYSIS OF SHELLS OF REVOLUTION
Rudy Beeckman and Daniel VanLeeuwen (Ghent Univ.) Oct. 1973 42 p refs
(CRIF-MT-84) Avail: NTIS HC $5.25

The use of a truncated cone element for the elastic structural analysis of shells of revolution under axisymmetric and asymmetric loading conditions is discussed. The terms of the stiffness matrix were evaluated analytically without any approximating numerical integration method being used. This leads to a consistent improvement in accuracy and a considerable reduction of computing time. Several examples were solved on a digital computer and the results compared to theoretical and experimental data, showing an excellent correlation for a relatively small number of elements. Author (ESRO)

N74-19562# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.
TESTS ON COMPOSITE BEAMS ON THREE PIERS [ESSAIS DE POUTRES MIXTRES SUR TROIS APPUIS]
Jose Janss and J.-C. Lambert Nov. 1973 36 p refs In FRENCH Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-MT-85) Avail: NTIS HC $5.00

Ten hyperstatic steel reinforced continuous concrete beams lying on three piers were tested. It was shown that when the concrete under traction is solicited - in the zones of negative moments - in excess of 0.0001 mm/mm a new moment distribution and shear efforts must be taken into account by considering the beam as having a variable inertia (increase of the bay moments). Proposals for new distributions are presented. Calculation of destructive load is easily performed following the theory of plastic deformation of continuous beams by considering the appearance of plastic knee joints at the central support and extremities. ESRO

N74-19563# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
STRUCTURAL REPRESENTATION IN AEROELASTIC CALCULATIONS
L. T. Niblett London ARC 1973 12 p refs
(ARC-R/M-3729) Avail: NTIS HC $4.00; HMSO 50p; PHI $2.15

The practicability of allowing approximately for the higher-frequency normal modes of a structure by using a residual flexibility matrix is examined. A better method of approximation which retains the concept of residual flexibility is discussed, and arguments in favour of it are given. Author (ESRO)

N74-19564# Bristol Univ. (England).
KRON'S METHOD: AN ALGORITHM FOR THE EIGENVALUE ANALYSIS OF LARGE-SCALE STRUCTURAL SYSTEMS
A. Simpson London ARC 1973 16 p refs Supersedes ARC-34098
(ARC-R/M-3733; ARC-34098) Avail: NTIS HC $4.00; HMSO 60p; PHI $2.55

The Kron eigenvalue procedure is established by the application of Hamilton's principle to a constrained primitive Lagrangian comprising the characteristics of the various subsystems into which a composite system is torn to facilitate analysis. The computational merits of the method are outlined, particularly in relation to a scanning algorithm derived from a procedure developed by Wittrick and Williams. Author (ESRO)

N74-19565# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
VIBRATION AMPLITUDES PRODUCED IN ST. DAVID'S CATHEDRAL BY CONCORDE SONIC BANGS
F. L. Hunt London ARC 1973 31 p refs Supersedes RAE-TR-71121; ARC-33123
(ARC-R/M-3736; RAE-TR-71121; ARC-33123) Avail: NTIS HC $4.75; HMSO£ 1.10; PHI $4.30

At St. David's Cathedral, structural vibrations produced by a number of Concorde sonic bangs were measured and compared with the vibration produced by the structures normal environment. The results show that bang produced amplitudes are not very much greater than the environmental vibration amplitudes. It is unlikely that continued exposure of the Cathedral to sonic bangs would result in appreciably accelerated structural decay. Author (ESRO)

N74-19566# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
AN EXPERIMENTAL ASSESSMENT OF THE POSSIBLITY OF DAMAGE TO LEADED WINDOWS BY SONIC BANGS
F. L. Hunt London ARC 1973 28 p refs Supersedes RAE-TR-69282; ARC-32663
(ARC-R/M-3737; RAE-TR-69282; ARC-32663) Avail: NTIS HC $4.50; HMSO£ 1.05; PHI $4.05

Some leaded windows have been subjected to a series of sonic bang response tests using a specially developed explosive simulated bang. The tests covered a range of bang pressures and durations. Results show that the likelihood of damage to leaded windows by normal sonic bangs is very small. Author (ESRO)

N74-19567# Royal Aircraft Establishment, Farnborough (England).
A THEORETICAL STUDY OF INACCURACIES ARISING FROM THE REPRESENTATION OF A CONTINUOUS GUST SPECTRUM BY A PROGRAMME OF DISCRETE LOADS IN FATIGUE TESTS
A. M. Stagg Aug. 1973 66 p refs
(BR37134; RAE-TR-73085) Avail: NTIS HC $6.50

A theoretical analysis has been made of the inaccuracies involved in the representation of a continuous distribution of aircraft gust loads by a program of loads at a few discrete levels to be applied to a fatigue test specimen. These inaccuracies arise through the failure of the simplified test load program to inflict fatigue damage at the correct rate in those parts of the specimen where the stress per unit acceleration has a value other than that for which the test loading was derived. Three severities of gust spectrum and two families of S-N curve were used in the fatigue damage calculations which were based on Miner's hypothesis. The number of discrete load levels in the derived program varied from one to seven. Two main conclusions are reached, namely that the more load levels used in the test representation the better is the accuracy of the simulation and that the chosen levels should encompass the most damaging level of load in the continuous service spectrum. It is believed that the trends noted can be related to other forms of continuous spectrum and other types of S-N curve. Author (ESRO)

N74-19568# Wisconsin Univ., Madison. Dept. of Mathematics.
A NOTE ON TOPOLOGICAL DEGREE FOR POTENTIAL OPERATORS
Paul H. Rabinowitz Nov. 1973 11 p refs
(Contract N00014-67-A-0128-0024)
(AD-771761) Avail: NTIS CSCL 12/1

The index of an isolated critical point which is also a local minimum is shown to be one for a class of functionals of interest. The result is applied to study the number of possible buckled states possessed by a thin elastic shell. Author (GRA)

N74-19569# Ballistic Research Labs., Aberdeen Proving Ground, Md.

CRACK NUCLEATION CONCEPT STUDY
William S. DeRosset Dec. 1973 18 p refs
(DA Proj. 1W0-62105-A-659)
(AD-772985; BRL-MR-2342) Avail: NTIS CSCL 20/12

A crack nucleation model presented in this paper is based on two principal ideas. First, there is a flaw distribution in the material which can be characterized as to size, orientation, type or other (perhaps unknown) critical parameter. Secondly, when the stress reaches a critical value given by a Griffith-type condition, the flaw under consideration begins to grow and is considered nucleated. This model has two implications: (1) applied stress, as well as inherent microstructure, should be taken into account in deriving nucleation rates, and (2) cracks are nucleated only on the rising portion of the stress wave. Author (GRA)

N74-19570# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRENGTH ANALYSIS OF GLASS-FIBER-REINFORCED PLASTIC DURING BUCKLING
Ya. A. Brauns and R. B. Rikards 11 Dec. 1973 18 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 4, Jul./Aug. 1972 p 666-673
(AD-772724; FTD-HT-23-309-74) Avail: NTIS CSCL 20/11

An algorithm is developed for calculating and analyzing the stress tensor by the experimental function of deflections during the buckling of glass-fiber-reinforced plastic shells loaded with a hydrostatic load. Malmeyster's theory of strength is used to qualitatively establish the possible points of shell failure.
Author (GRA)

N74-19571# Watervliet Arsenal, N.Y.
RELATIVE OPTIMIZATION OF HAUGER'S PROBLEM WITH CIRCULAR CROSS SECTION
Charles R. Thomas Oct. 1973 42 p refs
(AD-771173/2GA; R-WV-T-6-44-73) Avail: NTIS HC $4.25 CSCL 20/11

A relative optimization of Hauger's problem with a circular cross-section is accomplished by the application of an adjoint variational principle in conjunction with a generalized Ritz procedure. Considerable weight reductions are shown to be possible within the bounds of imposed constraints for a two term Ritz approximation of Hauger's problem. The circular cross-section optimization is shown to yield a relative lower mass than a corresponding procedure for a rectangular cross-section.
Author (GRA)

N74-19572# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
DEVELOPMENT OF ELASTIC-PLASTIC FINITE ELEMENT ANALYSIS OF BODIES OF REVOLUTION WITH DIFFERENT ORTHOTROPIC, TEMPERATURE-DEPENDENT MATERIAL PROPERTIES IN TENSION AND COMPRESSION
S. R. Lin 8 Oct. 1973 43 p refs
(Contract F04701-73-C-0074)
(AD-772712; TR-0074(4901-01)-4; SAMSO-TR-73-390) Avail: NTIS CSCL 20/11

The first phase progress report for the development of an elastic-plastic finite element analysis of bodies of revolution with different orthotropic, temperature-dependent material properties in tension and compression is presented. The formulation of linear-strain triangular finite element equations and their associated iterative initial-strain solution technique are given. A method of analyzing plastic deformations of anisotropic materials is proposed. Author (GRA)

N74-19573# Army Foreign Science and Technology Center, Charlottesville, Va.
METHOD OF ELASTIC SOLUTIONS IN THE THEORY OF PLASTICITY
L. L. Boiko 6 Dec. 1973 16 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. Mat., Mekhan. (Moscow), no. 5, 1970 p 108-116
(AD-772453; FSTC-HT-23-2073-72) Avail: NTIS CSCL 20/11

The author defines and contrasts two different methods for arriving at elastic solutions in the theory of plasticity. One method has been put forth as a means of solving problems in the theory of flow when deformation of an element of the body is complex. The other method, which is similar, has been applied to elastic solutions in the theory of small elastic-plastic deformation. (Modified author abstract) GRA

N74-19574# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
USE OF A TAYLOR SERIES CORRECTION METHOD IN PHOTOELASTIC STRESS INTENSITY DETERMINATION
M. A. Schroedl, J. J. McGowan, and C. W. Smith Aug. 1973 39 p refs
(Contract DAAF07-69-C-0444)
(AD-773039; VPI-E-73-34) Avail: NTIS CSCL 20/11

A technique is described for extracting stress intensity factors from photoelastic data which uses a Taylor Series expansion of the in-plane maximum shearing stress in conjunction with a digital computer program. By applying the method to a variety of problems including center cracked panels, compact tension specimens, part-circular surface flaws and flat bottomed surface flaws, characteristics of the method are demonstrated, and its strengths and weaknesses are delineated. It is concluded that stress freezing photoelasticity appears to be a potentially powerful tool for estimating stress intensity factors for complex three dimensional problems. Author (GRA)

N74-19575# Systems Science and Software, La Jolla, Calif.
SENSITIVITY OF MATERIAL RESPONSE CALCULATIONS TO THE EQUATION OF STATE MODEL Final Report, May - Oct. 1973
William O. Wray Dec. 1973 63 p refs
(Contract DAAD05-73-C-0489; DA Proj. 1W0-62105-A-659) (AD-772919; SSS-R-73-1910; BRL-130) Avail: NTIS CSCL 20/12

The report examines the sensitivity of material response calculations to the choice of equation of state model. Three equation of state models, all of which are available as subroutines in the RIP code, are considered: (1) modified PUFF; (2) RIP mixed phase; and (3) GRAY. Each of these models is used to calculate the one-dimensional response of aluminum, beryllium and titanium; this series of calculations is performed for two distinct X-ray sources. The sensitivity of the calculated material response to the choice of equation of state model is characterized in terms of the generated impulse and the peak propagating stress at the time the radiation source is cut off. For the calculations presented in this report, the three equation of state models are in fairly good agreement. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N74-19576 California Univ., Los Angeles.
STUDIES OF OPPOSED JET DIFFUSION FLAMES Ph.D. Thesis
Natver Kasanji Patel 1973 113 p
Avail: Univ. Microfilms Order No. 73-32677

Opposed jet diffusion flames using ethylene, methane and carbon monoxide as fuels were studied. The effects of superficial mass velocity, and fuel and oxygen concentrations on the temperature and concentration profiles of the flames were determined. Oxidant and fuel jets flow from the top and bottom cylinders, respectively. Superficial mass velocities of the oxidant and fuel jets were equal for the ethylene and methane flames. Ethylene and methane flames behave similarly. The important mechanisms of mass and energy transport are diffusion and conduction, respectively, in the vicinity of hydrodynamic center plane. The shape of the flame resembles a flat disc. Isotherms are essentially horizontal with a small inclination upward toward the periphery. Maximum temperatures occur near the periphery.
Dissert. Abstr.

N74-19577 Wisconsin Univ., Madison.
THE TRANSITION FROM FORCED- TO FREE-CONVECTIVE HEAT TRANSFER FROM A HEATED VERTICAL PLATE IN AIR WITH THE BUOYANT AND INERTIAL FORCES OPPOSED Ph.D. Thesis
James Robert Gloudemans 1973 261 p
Avail: Univ. Microfilms Order No. 74-21153

Mixed convective heat transfer from a heated vertical plate was determined interferometrically and by numerical analysis. These mixed convection studies relate to the opposing-flow accident. Experimental local and mean convective heat transfer coefficients were determined at flow rates from 1.7 to 17 fps, and for plate-to-ambient temperature differences of 50, 100, and 150 F. The mixed flow parameter range was $0.004 < Gr/sqRe < 1$. Transient effects were studied. Coefficients at coastdown periods of 4.25, 125, and 250 seconds (and steadystate data) were examined. Instantaneous convective heat transfer coefficients had no detectable dependence on flow deceleration rate. Local and mean coefficient variations with flow rate were grouped into three regimes of convective heat transfer, intermediate to the forced and free regimes. These were the unsteady (forced), vortex, and suppressed (free) convective regimes. Dissert. Abstr.

N74-19578 Notre Dame Univ., Ind.
ENTROPY OF LIQUID HELIUM II FROM FOUNTAIN PRESSURE MEASUREMENTS Ph.D. Thesis
Alfred Louis Broz 1973 170 p
Avail: Univ. Microfilms Order No. 74-45

Fountain pressure measurements have been made for the temperature range 0.94 K to 1.56 K. A temperature difference (delta T) was set up between the liquid inside and outside of a thermally insulated coaxial capacitor. The resulting level difference (delta P) was measured by measuring the capacitance of this capacitor. Porous membrane filter material of pore size ranging from 0.1 micron to 8 microns was used as the superleak connecting the liquid inside and outside the capacitor. Level differences delta P corresponding to delta T ranging from 50 micron K to 2 milli K were recorded at each of the ambient temperatures. A linear relationship between the measured delta P and delta T was always obtained. The value of delta P/delta T at each of these ambient temperatures was measured with precision of plus or minus 0.1%. The value of the entropy at each of these ambient temperatures was calculated from this data with an accuracy of plus or minus 1.1%. These entropy values are compared with those obtained from other measurements and found to be in good agreement. Dissert. Abstr.

N74-19579*# Auburn Univ., Ala. Thermoscience Group.
THERMAL CONDUCTIVITY OF HETEROGENEOUS MIXTURES AND LUNAR SOILS Final Report
R. I. Vachon, A. G. Prakouras, R. Crane, and M. S. Khader Oct. 1973 389 p refs
(Contract NAS8-26579)
(NASA-CR-120162) Avail: NTIS HC $22.50 CSCL 20M

The theoretical evaluation of the effective thermal conductivity of granular materials is discussed with emphasis upon the heat transport properties of lunar soil. The following types of models are compared: probabilistic, parallel isotherm, stochastic, lunar, and a model based on nonlinear heat flow system synthesis. S.K.W.

N74-19580*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
HEAT TRANSFER AND MIXING OF SLUSH HYDROGEN Final Report
C. F. Sindt and P. R. Ludtke Nov. 1973 40 p refs
(NASA Order W-13300)
(NASA-CR-137249; NBSIR-73-344) Avail: NTIS HC $5.00

Heat transfer to slush hydrogen and mixing were investigated in a 1 cubic meter cylindrical vessel. The effects of heat transfer rates on thermal stratification and on self-pressurization were measured. Temperature profiles in thermal stratification were found to be more dependent on slush level and slush setting rates than on liquid level. Solids in the slush appear to be involved in the heat transfer mechanism as slush level affected the amount of warm liquid reaching the top of the dewar and therefore affected the self-pressurization rates. Mixing effectiveness and power requirements to mix slush hydrogen were determined for two configurations of turbine mixers and one paddle mixer. Mixing power requirements were found to be sensitive to the mixer location and configuration. Author

N74-19581*# McDonnell-Douglas Astronautics Co., Richland, Wash.
INVESTIGATION OF ARTERIAL GAS OCCLUSIONS Final Report, 22 May 1973 - 22 Jan. 1974
E. W. Saaski Mar. 1974 89 p refs
(Contract NAS2-7596)
(NASA-CR-114731; MDC-G4437) Avail: NTIS HC $7.50 CSCL 20M

The effect of noncondensable gases on high-performance arterial heat pipes was investigated both analytically and experimentally. Models have been generated which characterize the dissolution of gases in condensate, and the diffusional loss of dissolved gases from condensate in arterial flow. These processes, and others, were used to postulate stability criteria for arterial heat pipes under isothermal and non-isothermal condensate flow conditions. A rigorous second-order gas-loaded heat pipe model, incorporating axial conduction and one-dimensional vapor transport, was produced and used for thermal and gas studies. A Freon-22 (CHClF2) heat pipe was used with helium and xenon to validate modeling. With helium, experimental data compared well with theory. Unusual gas-control effects with xenon were attributed to high solubility. Author

N74-19582*# Hughes Aircraft Co., Culver City, Calif.
METAL-WOOL HEAT SHIELDS FOR SPACE SHUTTLE
Robert C. Miller and John L. Clure Mar. 1974 60 p refs
(Contract NAS1-12427)
(NASA-CR-132389) Avail: NTIS HC $6.00 CSCL 20M

The packaging of metal wool for reusable thermal heat shields applied to aerodynamic and other surfaces for the space shuttle was analyzed and designed, and samples were fabricated and experimentally studied. Parametric trends were prepared for selected configurations. An all-metal thermally efficient, reliable, reusable and producible heat shield system was designed and structurally tested for use on spacecraft aerodynamic surfaces where temperatures do not exceed 810 K. Stainless steel sheet, primarily for structure and secondarily in the transverse plane for thermal expansion, was shown to accommodate thermal expansion in all directions when restrained at the edges and heated to 1360 K. Aerodynamic loads of 0.35 x 1000, 000 newtons/sq meter, and higher, may be easily accepted by structures of this design. Seven all-metal thermal protection specimens, 12.7 cm square and 2.5 cm thick were fabricated and are being experimentally evaluated at simulated shuttle entry conditions in an arc jet facility. Author

N74-19583*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SELF-REGULATING PROPORTIONALLY CONTROLLED HEATING APPARATUS AND TECHNIQUE Patent Application
Maxwell G. Strange, inventor (to NASA) Filed 27 Feb. 1974 17 p
(NASA-Case-GSC-11752-1; US-Patent-Appl-SN-446569) Avail: NTIS HC $4.00 CSCL 20M

A self-regulating, proportionally controlled heating apparatus is described. In the device, a single electrical resistance heating element having a temperature coefficient of resistance serves simultaneously as a heater and a temperature sensor. Block diagrams are provided of the electrical circuits involved. The equipment provides precision control of the temperature of a heater element in a proportional and continuous fashion and eliminates the need for a temperature sensor apart from the heater element itself. NASA

N74-19584*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF FORMING A WICK FOR A HEAT PIPE Patent Application
Frank G. Arcella (Westinghouse Elec. Corp.), Ernest C. Phillips (Westinghouse Elec. Corp.), and Richard P. Sprecace, inventors (to NASA) (Westinghouse Elec. Corp.) Filed 27 Feb. 1974 10 p Prepared for JPL

(Contracts NAS7-100; JPL-953074)
(NASA-Case-NPO-13391-1; US-Patent-Appl-SN-446567) Avail: NTIS HC $4.00 CSCL 20M

A method for forming a tubular wick for heat pipes is presented. The method consists of steps involving forming the wick blank of a predetermined thickness from multiple layers of stainless steel screen mesh. The process makes it possible to reduce the pore size of the wicks by approximetely fifty percent. NASA

N74-19585*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CROSSFLOW EFFECTS ON IMPINGEMENT COOLING OF A TURBINE VANE
James W. Gauntner, Herbert J. Gladden, Daniel J. Gauntner, and Frederick C. Yeh Washington Mar. 1974 20 p refs
(NASA-TM-X-3029; E-7768) Avail: NTIS HC $3.00 CSCL 20M

An air-cooled turbine vane was tested in a four-vane cascade. Heat transfer characteristics of the impingement cooled midchord region are reported. Experimental Nusselt numbers of six midchord locations are examined for the effect of crossflow and compared to those predicted by impingement correlations found in the literature. Author

N74-19586# Federal Power Commission, Washington, D.C. Planning and Development Div.
NATURAL GAS SUPPLY IN THE DECADE OF THE SEVENTIES
Gordon K. Zareski Mar. 1973 19 p refs Presented at the 74th Natl. Meeting of the Am. Inst. of Chem. Engr., New Orleans, 13 Mar. 1973
Avail: NTIS HC $4.00

The energy situation with respect to natural gas as an energy source was studied. Factors which contributed to the current shortage of natural gas supplied are analyzed. Federal actions to develop the policies necessary to increase the supply of natural gas and to encourage optimum use of this energy source are reported. Possible future sources of natural gas to supplement the shortage are identified. Tables, maps, and graphs are included to show the natural gas supply. P.N.F.

N74-19587# Federal Power Commission, Washington, D.C. Analysis and Procedures Div.
NATURAL GAS AVAILABILITY: PRESENT AND FUTURE
Gordon K. Zareski May 1972 13 p Presented at Symp. on Gaseous Fueled Vehicles and the Environ., Washington, D. C., 24-26 May 1972
Avail: NTIS HC $4.00

An analysis of the availability of natural gas and gas reserves in the United States is presented. The actual and projected demand for gas during the 1950 to 1990 time period is analyzed. Historical trends in natural gas production and reserve additions are illustrated. A graph of the annual demand for natural gas is plotted to show the levels of domestic productive capacity with annual reserve additions of 30, 25, and 20 trillion cubic feet. P.N.F.

N74-19588# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
KINETIC ENERGY OF TURBULENCE IN FLAMES
K. N. C. Bray Feb. 1974 39 p refs Paper prepared for AGARD Propulsion and Energetics Panel Specialists' Meeting: Anal. and Numerical Methods for Investigation of Flow Fields with Chem. Reactions Especially Related to Combust., Liege, 1-2 Apr. 1974
(AASU-332) Avail: NTIS HC $5.00

The exact equations of turbulent, reacting flow are used, together with an order of magnitude analysis, to derive an approximate form of the turbulence kinetic energy balance equation for premixed, two-dimensional, turbulent flames at low Mach number and high Reynolds number. Plausible closure hypotheses are then introduced, in order to obtain an equation which reduces to a familiar form of the turbulence kinetic energy equation, in the case of non-reacting flow of constant density. Additional terms, related to heat release and mass transport, become important in turbulent flames. Experimentally observed effects of turbulence on a variety of turbulent flame configurations are discussed in terms of this equation. Author

N74-19589# Rocket Propulsion Establishment, Westcott (England).
THE BURNING OF OIL IN WRECKED TANKERS LARGE SCALE BURNING TEST
J. Diederichsen, A. R. Hall, and A. T. Jeffs Dec. 1972 37 p refs
(RPE-TR-72/9; BR37051) Avail: NTIS HC $5.00

A test was made of the burning characteristics of about 175 tons of crude oil in a tank with sides 6 m long and with two vents, one in the roof and one high in one side. In conjunction with the results of previous tests using small models, it is now possible to specify the conditions for the effective combustion of oil in the compartments of a wrecked tanker and to predict burning rates for a range of wind speeds. Author (ESRO)

N74-19590# Avco Corp., Richmond, Ind. Precision Products Div.
ENGINEERING DEVELOPMENT OF THE MECHANICAL BI-DIRECTIONAL DECELEROMETER Final Report, Jun. 1972 - Feb. 1973
David C. Norton Eglin AFB, Fla. AFATL May 1973 57 p
(Contract F08635-72-C-0202; AF Proj. 3133)
(AD-771801; AFATL-TR-73-113) Avail: NTIS CSCL 19/1

The objective of this program was to develop an environmental sensor which would monitor and analyze the environments associated with a high-drag bomb deployment to allow fuze arming only when the deployment was proper. The sensor developed is compatible with both nose and tail fuze wells of high-drag general-purpose bombs and has been designated the Mechanical Bi-Directional Decelerometer. The sensor developed is a miniaturization and refinement of the one developed under Contract No. F08635-70-C-0097 with the Air Force Armament Laboratory. The result of the miniaturization is that the new sensor only requires approximately one-half the volume of the original sensor (0.93 cubic inch versus 1.6 cubic inches). The result of the design refinement is that the new sensor has additional safety features to assure that it will not allow fuze arming when the deployment of the retardation device is unsatisfactory. Author (GRA)

N74-19591# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
KINETIC PHENOMENA IN A KNUDSEN GAS WITH ROTATIONAL DEGREE OF FREEDOM
V. D. Borman, L. A. Maksimov, B. I. Nikolaev, and V. I. Troyan 9 Nov. 1973 18 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 64, no. 2, 1973 p 526-535
(AD-771652; FTD-HT-23-746-74) Avail: NTIS CSCL 07/4

The authors examine the heat transfer in a strongly rarefied gas in an arbitrarily oriented magnetic field. They discuss the boundary conditions for the distribution function of a gas with spinning molecules, and show that the heat flux in a molecular Knudsen gas can be changed in a magnetic field if the coefficient of diffuse reflection depends on the direction of the angular momentum of the molecular. GRA

N74-19592# Army Foreign Science and Technology Center, Charlottesville, Va.
DESIGN OF REGENERATIVE HEAT EXCHANGERS WITH VARIABLE DISCHARGE OF GASES
B. M. Datskovskii 26 Jul. 1973 6 p refs Transl. into ENGLISH from Kholod. Tek. Tekhnol. (Kiev), 1970
(AD-771083; FSTC-HT-23-2152-72) Avail: NTIS CSCL 13/1

An approximate analytical method for designing regenerative heat exchangers with monotonic variable discharge of gases is described. Results of several example calculations of the regenerative heat exchangers are given. GRA

N74-19593# Santa Clara Univ., Calif. Dept. of Mechanical Engineering.
EFFECT OF PRESSURE ON IGNITION OF HYPERGOLIC LIQUID PROPELLANTS Final Report
Michel A. Saad, Gene J. Antonides, and Samuel R. Goldwasser Jun. 1973 12 p
(Grant AF-AFOSR-1478-68; AF Proj. 9711)

(AD-772756; AFOSR-73-1992TR) Avail: NTIS CSCL 21/2

The ignition behavior of hypergolic liquid is influenced by ambient pressure. Therefore emphasis has been placed on the determination of how pressure affects the rates at which energy is released, absorbed, and distributed. The ignition phenomenon has been examined experimentally in a test facility, where it was possible to establish the relationship between small changes in physical environment and changes in ignition of hypergolic liquids. Ignition at low pressure was investigated with theoretical techniques, applying thermochemistry to determine amounts of energy involved, chemical kinetics to establish rates of energy release, evaporation studies to indicate rates of energy absorption, and heat transfer to clarify the distribution of energy within a propellant droplet. While the work has centered about the ignition of hydrazine-containing hypergolic liquids at low pressures, the attempt has also been made to derive generalizations which might apply to similar systems. (Modified author abstract) GRA

N74-19594# Stanford Research Inst., Menlo Park, Calif.
SOLID PROPELLANT KINETICS. 4: MEASUREMENT OF KINETIC PARAMETERS IN THE OPPOSED FLOW SOLID PROPELLANT DIFFUSION FLAMES
S. J. Wiersma and H. Wise 20 Dec. 1973 37 p refs
(Contract N00014-70-C-0155; SRI Proj. PYU-8378)
(AD-773117) Avail: NTIS CSCL 21/2

To examine the gas-kinetics parameters pertinent to the flame reactions of ammonium perchlorate (AP) based propellants the authors employed the heterogeneous opposed flow diffusion flame. In this combustion system a diffusion flame is formed in the stagnation region between a gaseous stream of fuel and an opposing stream of oxidizer originating at the solid surface of AP. With increasing fuel flux the steady-state mass flux of AP reaches a value at which the kinetics of reaction limit the consumption of reactants. Both the composition of the solid oxidizer and the gaseous fuel were varied in the experimental studies. The effects of different catalysts and solid fuels were examined on the burning rate characteristics of the solid phase. A number of gaseous hydrocarbon fuels were used. Based on the results kinetic expressions are derived for the overall combustion progress in the diffusion flame of solid propellants based on AP. (Modified author abstract) GRA

N74-19595# General Electric Co., Philadelphia, Pa. Missile and Space Div.
INFRARED VIDICON OBSERVATION OF EXPLODING BALLOON EVENTS
Fred N. Alyea Griffiss AFB, N.Y. RADC Oct. 1973 46 p refs
(Contract F30602-73-C-0102; ARPA Order 1649; AF Proj. 1649)
(AD-772754; RADC-TR-73-365) Avail: NTIS CSCL 19/4

Predictions of the IR radiation produced by the debris of stoichiometric CO/O2/H2O and CH4/O2 explosion mixtures have been made. The calculation considered optical thickness effects as well as spatial and temporal variations of the major species, CO2 and H2O and temperature. The results show that the spectral intensity is a strong function of wavelength and determined in part by the optical thickness of the cloud. The predictions have been applied to select appropriate filters for an infrared vidicon sensor system which will be used for observation of balloons exploded in the field. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N74-19596 National Center of Scientific and Technological Information, Tel Aviv (Israel).
CURRENT RESEARCH AND DEVELOPMENT PROJECTS IN ISRAEL 1972: NATURAL SCIENCES AND TECHNOLOGY, VOLUME 1: MAIN TABLES
C. Keren, ed. and P. Wollman, ed. Apr. 1973 471 p
Copyright Avail: Issuing Activity

An index of research projects conducted by a research facility in Israel during 1972 is presented. The register of current research provides a means of locating individual expertise in specific fields. The index also provides statistical data on the activities of the population it deals with, their institutional adherence, trends of investment in research and development, and other data needed for formulation of science policy. The procedures used in data collection and processing are explained. The classification system used for the index is defined. Author

N74-19597 National Center of Scientific and Technological Information, Tel Aviv (Israel).
CURRENT RESEARCH AND DEVELOPMENT PROJECTS IN ISRAEL 1972: NATURAL SCIENCES AND TECHNOLOGY, VOLUME 2: INDEXES
C. Keren, ed. and P. Wollman, ed. Apr. 1973 375 p
Copyright. Avail: Issuing Activity
For abstract, see N74-19596

N74-19598*+ National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS
Jan. 1974 756 p refs
(NASA-SP-7039(04)-Sect-1) Avail: NTIS HC $9.00 CSCL 05B

This bibliography lists 2594 NASA patents and applications for patents introduced into the NASA scientific and technical information system between May 1969 and December 1973. The publication is issued in two sections: Section 1, Abstracts and Section 2, Indexes. Each entry in the Abstract section consists of a citation, an abstract, and, in most cases, a key illustration selected from the patent or application for patent. The abstracts are indexed according to subject, inventor, source, number, and accession number. Author

N74-19599*+ National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES
1974 446 p refs
(NASA-SP-7039(04)-Sect-2) Avail: NTIS HC $4.50 CSCL 05B
For abstract, see N74-19598.

N74-19600*# Denver Research Inst., Colo. Industrial Economics Div.
PROGRAM FOR TRANSFER RESEARCH AND IMPACT STUDIES Semiannual Report, 1 Jan. - 30 Jun. 1973
J.-J. Rusnak, Eileen R. Staskin, and Joanne M. Hartley Nov. 1973 19 p
(Contract NASw-2362)
(NASA-CR-137230) Avail: NTIS HC $4.00 CSCL 05A

Research activities conducted under the program for Transfer Research and impact studies are reviewed. Programs include: Tech Brief - Technical Support Package (TSP) Program; transfer documentation; and technology transfer profiles. An analysis of user behavior patterns is made by studying questionnaires filled out by users of the Tech Brief - TSP program. The process of technology transfer is discussed in terms of improving its effectiveness. K.M.M.

N74-19601*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH AND TECHNOLOGY Progress Reports, 1 Apr. - 30 Sep. 1973
Oct. 1973 600 p refs
(NASA-TM-X-69942) Avail: NTIS HC $33.00 CSCL 05B

Summaries are presented of the research in the development of the space shuttle. Propulsion, materials, spacecraft and thermal control, payloads, instrumentation, data systems, and mission planning are included. F.O.S.

N74-19602*# Denver Research Inst., Colo. Industrial Economics Div.
A CASE STUDY OF TECHNOLOGY TRANSFER: CARDIOLOGY

Gerald Schafer Jan. 1974 29 p refs
(Contract NASw-2362)
Avail: NTIS HC $4.50 CSCL 05B

Research advancements in cardiology instrumentation and techniques are summarized. Emphasis is placed upon the following techniques: (1) development of electrodes which show good skin compatibility and wearer comfort; (2) contourography - a real time display system for showing the results of EKGs; (3) detection of arteriosclerosis by digital computer processing of X-ray photos; (4) automated, noninvasive systems for blood pressure measurement; (5) ultrasonoscope - a noninvasive device for use in diagnosis of aortic, mitral, and tricuspid valve disease; and (6) rechargable cardiac pacemakers. The formation of a biomedical applications team which is an interdisciplinary team to bridge the gap between the developers and users of technology is described. S.K.W.

N74-19603# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA'S EQUAL EMPLOYMENT OPPORTUNITY PROGRAM
Washington GPO 1974 101 p refs Hearing before Comm. on Aeron. and Space Sci., 93d Congr., 2d Sess., 24 Jan. 1974
Avail: SOD HC $1.10

NASA's efforts to increase minority and female representation in its work force are discussed. Problems encountered in complying with EEO standards and solutions to these problems are discussed. S.K.W.

N74-19604# Committee on Science and Astronautics (U. S. House).
H.R. 11864: SOLAR HEATING AND COOLING DEMONSTRATION ACT OF 1974. BACKGROUND AND LEGISLATIVE HISTORY
Washington GPO Feb. 1974 306 p refs Presented to Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., Feb. 1974
Avail: NTIS Avail: Subcomm. on Energy

The responses are reported of selected Federal agencies to requests, by the Committee, for information on current research in areas of solar energy. The nature of ongoing solar energy research, funding levels, and recommended areas for development are discussed. The legislative history of solar energy for heating and cooling, H.R. 11864 is included. F.O.S.

N74-19605# Select Committee on Small Business (U. S. House).
CONCENTRATION BY COMPETING RAW FUEL INDUSTRIES IN THE ENERGY MARKET AND ITS IMPACT ON SMALL BUSINESS. VOLUME 2: TENNESSEE VALLEY AREA
Washington GPO 1972 20 p Presented by Select Comm. on Small Business to the Comm. of the Whole House on the State of the Union, 92d Congr., 2d Sess., 8 Aug. 1972
(H-Rept-92-1313) Avail: U.S. Capitol, House Document Room

Hearings investigated the monopolistic impact of the growing economic concentration in the energy field and the reasons underlying the recent increases in electric rates in the Tennessee Valley Area. Electric rates have increased 25% and coal prices have risen 100% between 1971-72. Findings and recommendations concerning the causes and solutions to the escallating energy costs are included. K.M.M.

N74-19606# Joint Committe on Atomic Energy (U. S. Congress).
ATOMIC ENERGY COMMISSION 1 DECEMBER 1973 REPORT ON ENERGY RESEARCH AND DEVELOPMENT
Washington GPO 1974 783 p refs Hearing before Joint Comm. on Atomic Energy, 93d Congr., 1st Sess., 11 Dec. 1973
Avail: SOD HC $5.20

Congressional reports on future energy research and development programs are presented. Policies to regain and maintain national energy self-sufficiency are outlined: (1) the conservation of energy by decreasing consumption and increasing the technical efficiency of conversion processes; (2) increase the domestic production of oil and natural gas; (3) increase the use of coal; (4) expand the production of nuclear energy; and (5) promote the use of alternate energy sources such as hydro, geothermal, and solar. S.K.W.

N74-19607*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DOMESTIC WASH WATER RECLAMATION FOR REUSE AS COMMODE WATER SUPPLY USING FILTRATION: REVERSE-OSMOSIS SEPARATION TECHNIQUE
John B. Hall, Jr., Carmen E. Batten, and Judd R. Wilkins Washington Apr. 1974 36 p refs
(NASA-TN-D-7600; L-9431) Avail: NTIS HC $3.25 CSCL 06I

A combined filtration-reverse-osmosis water recovery system has been evaluated to determine its capability to reclaim domestic wash water for reuse as a commode water supply. The system produced water that met all chemical and physical requirements established by the U.S. Public Health Service for drinking water with the exception of carbon chloroform extractables, methylene blue active substances, and phenols. It is thought that this water is of sufficient quality to be reused as commode supply water. The feasibility of using a combined filtration and reverse-osmosis technique for reclaiming domestic wash water has been established. The use of such a technique for wash-water recovery will require a maintenance filter to remove solid materials including those less than 1 micron in size from the wash water. The reverse-osmosis module, if sufficiently protected from plugging, is an attractive low-energy technique for removing contaminants from domestic wash water. Author

N74-19608# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REPORT ON CURRENT RESEARCH AT THE INSTITUTO DE PESQUISAS ESPACIAIS
Sep. 1972 17 p refs Presented at 4th Intern. Symp. on Equatorial Aeronomy, Ibadan, Nigeria, 4-11 Sep. 1972
(INPE-235-RI/033) Avail: NTIS HC $4.00

The activities and responsibilities of a research facility in Brazil, South America are reported. The subjects investigated by the facility are as follows: (1) satellite communications, (2) remote sensing, (3) meteorology, (4) systems analysis, (5) geodesy, (6) extraterrestrial radiation, and (7) geomagnetism. A list of publications resulting from the research projects is provided. P.N.F.

N74-19609# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AN EXPERIMENT IN GRADUATE EDUCATION IN SCIENCE TECHNOLOGY IN BRAZIL
Amit Dutta-Roy May 1973 38 p refs
(INPE-332-RI/110) Avail: NTIS HC $5.00

Experimental educational programs for developing nations are discussed with emphasis upon how students can apply their knowledge to their nation's development. The following subject areas are dealt with: space science, meteorology, electronics and communication, mathematics, systems analysis, remote sensing and educational technology. The courses are oriented toward some definite objective and an attempt is made to achieve a balance between theory and practice. This model suits similar institutions in other developing countries. Author

N74-19610# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SUMMARY OF SPACE ACTIVITIES IN BRAZIL
1973 136 p refs Presented at COSPAR Plenary Meeting, Konstanz, West Germany, 1973.
(INPE-334-LAFE) Avail: NTIS HC $10.00

Summaries of research activities in space, natural resources, technology transference, and communications are presented. The coordination and planning of these projects are also discussed. S.K.W.

N74-19611# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
URBAN STUDIES
Suzanne Palocz Aug. 1972 102 p refs
(INPE-231-RI/030) Avail: NTIS HC $8.25

Systems methods are applied to urban problems. By utilizing this method one can synthetize new urban developments. The

analysis of established cities can be more readily done by the systems approach. Special emphasis is placed on introducing modern management principles to the field of urban design. The utilization of data collecting computer and image processing techniques is shown. Author

N74-19612# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ANNUAL RESEARCH SUMMARY, 1973
1973 124 p refs
Avail: NTIS HC $9.25

Summaries of electrical engineering research problems in theory, applications, and computational techniques are presented. Subjects discussed include: optimal control systems with constraints, digital process control systems, optimal control nonlinear systems, error and sensitivity analysis, estimation theory, problems of pursuit and evasion, and learning systems and pattern recognition. Specific applications include robotic controls, automation systems, urban mass transportation scheduling problems, and surveillance and control of transportation systems. Author

N74-19613# National Science Foundation, Washington, D.C.
AN ANALYSIS OF FEDERAL R AND D FUNDING BY FUNCTION, FISCAL YEARS 1969 - 1974 Surveys of Science Resources Series
Oct. 1973 75 p refs
(NSF-73-316) Avail: SOD HC $1.90

Federal research and development activities are analyzed by functional category. Some functions described include national security, space, health, transportation and communications, science and technology, and natural resources. Comparisons are made of relative changes in the leading areas of research and development. Government emphases and priorities are reported. S.K.W.

N74-19614# Geological Survey, Washington, D.C.
ENERGY RESOURCES OF THE UNITED STATES
P. K. Theobald, S. P. Schweinfurth, and D. C. Duncan 1972 30 p refs
(Circ-650) Avail: NTIS HC $4.50

Diagrams present the U.S. Geological Survey estimates of the United States resources of coal, petroleum liquids, natural gas, uranium, geothermal energy, and oil from oil shade. The short text accompanying each diagram outlines the method of estimation or the source of the estimate and defines the characteristics of each estimate. Where appropriate, comparisons with other estimates are also given. Author

N74-19615# Mitre Corp., McLean, Va.
ENERGY, RESOURCES AND THE ENVIRONMENT: A SET OF PRESENTATIONS
Richard S. Greeley Jun. 1973 79 p Presented at the US Inform. Agency Exhibit on Progr. and the Environ., Poland Intern. Trade Fair, Lodz, 18-22 Jun. 1973
(M73-61) Avail: NTIS HC $7.00

The fuel resources available to the world are described, including solar, nuclear fusion, nuclear fission, geothermal, tidal, hydro, and fossil energy sources. These resources are compared with estimated fuel consumption rates in the future. Solar, fusion, and fission with breeding are shown to represent essentially infinite energy sources. Methods are described for improving the efficiency and economy in the ways we use fuels. Savings of 10-15% appear possible in the near term. An energy ethic is described which involves changes to government regulations and tax policies and other institutions to promote efficiency and conservation in the use of fuels. The technology of advanced energy systems is described including automobile engines, mass transit systems, pollution control devices, fuel cells, and magnetohydrodynamic production of electricity. The need for a vigorous, international research and development program is discussed to provide assurance for continued supplies of clean, abundant energy. Author

N74-19616# National Bureau of Standards, Washington, D.C. institute for Basic Standards.
MASS AND MASS VALUES Final Report
Paul E. Pontius Jan. 1974 41 p refs
(NBS-Monograph-133) Avail: SOD HC $.70 as c13.44:133

A historical summary is presented of weighing, standards, and the assignment of value; and the interfacing of mass measurements with civilization. The methods of assigning mass values are discussed in detail along with ways to convert from values on one basis to values on another basis. Sample problems relating to the buoyant effect of the air are presented in the appendices. Author

N74-19617# Committee on Commerce (U. S. Senate).
COUNCIL ON ENERGY POLICY
Washington GPO 1973 225 p refs Hearings on S. 70 and S. 419 before Comm. on Com., 93d Congr., 1st Sess., 7-8 Feb. 1973
Avail: Comm. on Com.

Hearings on the establishment of a national energy resources advisory board are presented. Measures to coordinate energy policies and improve management of energy resources are outlined. S.K.W.

N74-19618# Committee on Interior and Insular Affairs (U. S. Senate).
THE GASOLINE SHORTAGE: A NATIONAL PERSPECTIVE
David M. Lindahl Washington GPO 1973 98 p refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 19 Jun. 1973 Prepared by Library of Congr.
Avail: Comm. on Interior and Insular Affairs

An overview is presented of factors contributing to the gasoline shortage, the extent of the shortage, and its impact on the country. Emphasis is placed upon problems of supply and demand and remedial actions taken to alleviate the problem. Author

N74-19619# European Atomic Energy Community, Ispra (Italy).
[PROGRESS IN REACTOR PROGRAMS AND NUCLEAR, PHYSICS, AND ELECTRONICS STUDIES] Annual Report
Oct. 1973 480 p refs
(EUR-5060) Avail: NTIS HC $27.00

Research projects conducted at the Joint Research Center of Ispra, Italy during 1972 are presented. The subjects discussed are: (1) a fast breeder program, (2) reactor safety program, (3) gas cooled reactor development, (4) nuclear materials, and (5) protection of the environment. Specific projects conducted by the various divisions of the facility are reported to show the nature of the support provided for nuclear reactor development and operation. P.N.F.

N74-19620# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
BRAZILIAN NATIONAL COMMITTEE FOR URSI
29 Aug. 1972 26 p refs Presented at 17th Gen. Assembly, Warsaw, 21-29 Aug. 1972
(INPE-229-URSI/1) Avail: NTIS HC $4.50

Research projects in radio sciences are reported. Reports include the following general areas: (1) radio measurements and standards; (2) radio and nonionized media; (3) ionosperic studies; (4) magnetospheric studies; (5) radio astronomy; (6) radio waves and circuits; (7) radio electronics; and (8) radio noise of terrestrial origin. S.K.W.

N74-19621# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE SYSTEMS ANALYSIS APPROACH TO SATELLITE EDUCATION IN BRAZIL
Mary Ann Cusack Feb. 1973 49 p Presented at SEAMO Conf., Singapore, Feb. 1973
(INPE-300-LAFE) Avail: NTIS HC $5.50

A systems approach for the introduction of advanced technological resources into the Brazilian primary school system is presented. Particular emphasis is placed upon the use of satellites to transmit educational programs. Methods for improving the curriculum and the development of audio visual media are outlined. Cost analyses were conducted as well as feasibility tests to ascertain the degree of technology acceptance in the classroom. S.K.W.

N74-19622# National Science Foundation, Washington, D.C.
GUIDE TO PROGRAMS, FISCAL YEAR 1974
1974 91 p
Avail: SOD HC $1.25

The assistance programs supported by the National Science Foundation during fiscal year 1974 are reported. The program listings describe the principal characteristics and basic purpose of each activity, eligibility requirements, closing dates (when applicable), and the address from which more detailed information, brochures, or application forms may be obtained. The scope of the subjects supported by the organization and the procedures for obtaining foundation support are described. Author

N74-19623# Joint Publications Research Service, Arlington, Va.
SCIENCE AND TRANSPORT
I. Ya. Aksenov 14 Mar. 1974 51 p refs Transl. into ENGLISH of the booklet "Nauka i Transport" Moscow, Znaniye, 1974 64 p
(JPRS-61482) Avail: NTIS HC $5.75

Data on the association of transportation to science and engineering are discussed. The basic scientific and technical problems of transportation along with suggestions for future improvements are outlined. Author

N74-19624# Mitre Corp., McLean, Va. Transportation Systems Engineering Dept.
US TRANSPORTATION: SOME ENERGY AND ENVIRONMENTAL CONSIDERATIONS
W. E. Fraize Sep. 1974 49 p refs
(M72-164) Avail: NTIS HC $5.50

The role of transportation in air pollution and consumption of energy, especially petroleum, is reviewed, with emphasis on the U. S. situation. Both technological and control measures for each problem area are discussed. Technological measures focus on the automobile, high speed ground transportation modes, and non-petroleum fuels, while control measures, which encourage the use of the more efficient transportation modes, are seen to offer significant benefits. The near future is discussed with respect to the impact of the U. S. Amended Clean Air Act of 1970. Transportation evolution over the next few decades is projected. Author

N74-19625# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD BULLETIN: MEETINGS, PUBLICATIONS, MEMBERSHIP
Jan. 1974 71 p refs
(AGARD-Bul-74/1) Avail: NTIS HC $6.75

Information on all the planned 1974 AGARD meetings is presented including dates, locations and brief descriptions of their themes. Also included is a list of all AGARD Publications which were released in 1973, together with their abstracts. Author

N74-19626# Advisory Group for Aerospace Research and Development, Paris (France).
SEMI-AUTOMATIC INDEXING: STATE OF THE ART
H. Fangmeyer (EURATOM, Ispra) Feb. 1974 26 p refs
(AGARDograph-179; AGARD-AG-179) Avail: NTIS HC $4.50

The state of the art of semiautomatic indexing for information retrieval systems is discussed in the following areas: (1) semiautomatic derivative indexing; (2) machine-aided assignment indexing (including automatic assignment indexing techniques based on previously created manual or semiautomatic indexing aids); and (3) semiautomatic dictionary construction. Semiautomatic indexing is divided into conversational and symbiotic indexing in order to distinguish between indexing by continuous contact with the computer and indexing by integration of the computer in the indexing process for the purpose of performing certain clerical tasks. Author

N74-19627# National Bureau of Standards, Washington, D.C. Systems and Software Div.
A MECHANIZED INFORMATION SERVICES CATALOG
Beatrice Marron, Elizabeth Fong, and Dennis Fife Feb. 1974 56 p refs
(Grant NSF CA-68)
(NBS-TN-814) Avail: SOD HC $0.90 as C13.46:814

A catalog of currently available information sources and services is discussed. Information from recent surveys of machine-readable, commercially-available bibliographic data bases, and the various current awareness, batch retrospective, and interactive retrospective services which can access them, were correlated and converted into a machine-readable data base. A prototype searching capability was established on an operational interactive retrieval system. Reasons for establishing the catalog and the choice of the initial information are detailed and the prototype implementation is described. Sample queries are included, as well as a to-date listing of the catalog. Author

N74-19628# Research Triangle Inst., Research Triangle Park, N.C.
SIMULATION STUDIES FOR NOAA STABILIZED COMPENSATION PROGRAM Final Report, 21 Apr. 1972 - 20 May 1973
W. Howard Ruedger Aug. 1973 126 p refs
(Contract NOAA-NESS-2-35369)
Avail: NTIS HC $9.50

Long-term observation of the quality of the data from the scanning radiometer systems aboard the ITOS type spacecraft has indicated that a requirement exists for a systematic means of maintaining data quality. Previous studies have further indicated that the alignment of the equipment used to compensate for spacecraft tape recorder flutter effects was particularly sensitive in affecting data quality. This equipment was selected as the subject of a pilot program to assure data quality by stabilized control. Analyses of the z-axis* compensation technique as it interacts with the data were conducted. Diagnostic logic was used to survey data quality as the data was ingested from the command and data acquisition station. Author

N74-19629# Stanford Research Inst., Menlo Park, Calif.
MEETING CALIFORNIA'S ENERGY REQUIREMENTS, 1975-2000
May 1973 412 p refs Sponsored by Los Angeles Dept. of Water and Power, Pacific Gas and Elec. Co., Sacramento Municipal Utility District, San Diego Gas and Elec. Co., and Southern Calif. Edison Co.
(SRI Proj. ECC-2355)
Avail: NTIS HC $23.75

A study was conducted to determine various aspects of the present and future energy requirements for the State of California. The specific objectives of the study are as follows: (1) to assess the economic framework and related demand for energy, (2) to determine means for altering the projected demand pattern, requirements for implementing each of these demands, and appraisal of their significance, (3) to analyze the future supply from each source of energy and the factors affecting availability and use, and (4) to predict probable future trends in price. Author

N74-19630*# National Aeronautics and Space Administration, Washington, D.C.
NASA'S UNIVERSITY PROGRAM: ACTIVE GRANTS AND RESEARCH CONTRACTS, FISCAL YEAR 1973
1973 344 p
(NASA-TM-X-69964) Avail: NTIS HC $2.50

Indexes of research grants of the NASA University Program are presented. Only projects funded during the fiscal year 1973 are included. S.K.W.

N74-19631*# Amerind Publishing Co. Pvt. Ltd., New Delhi (India)
SONS OF THE BLUE PLANET
L. Lebedev, B. Lukyanov, and A. Romanov 1973 334 p Transl. into ENGLISH of the publ. "Syny Goluboi Planety" Moscow, Political Lit., 1971 Sponsored by NASA and NSF
(NASA-TT-F-728; TT-72-52004) Avail: NTIS HC $19.75 CSCL 22C

A summary of the progress of the U.S.S.R. Space Program is presented for the years 1961-1972, with emphasis on bibliographic sketches of Soviet astronauts. Space flights are detailed, and astronaut training is discussed. K.M.M.

N74-19632*# Amerind Publishing Co. Pvt. Ltd., New Delhi (India).

CONQUEST OF OUTER SPACE IN THE USSR: OFFICIAL ANNOUNCEMENTS BY TASS AND MATERIAL PUBLISHED IN THE NATIONAL PRESS FROM OCTOBER 1967 TO 1970

G. I. Petroy, ed. 1973 458 p Transl. into ENGLISH of the publ. "Osvoenie Kosmicheskogo Prostranstva v SSSR: Ofitsialnye Soobshcheniya TASS i Materialy Tsentralnoi Pechati Oktyabr', 1967-1970 gg." Moscow, Nauka, 1971 Sponsored by NASA and NSF

(NASA-TT-F-725; TT-72-52005) Avail: NTIS HC $26.00 CSCL 22C

The achievements of the Soviet Union in the outer space program recorded in the national press from October, 1967 to 1970, TASS announcements, press conference reports, and articles by leading scientists are included. This collection of articles depicts the main stages of Soviet space exploration during this period: the first automatic docking in space, the launching of the Soyuz manned spacecraft, and the space probes Zond and Luna for the moon and Venera for the planets. Material regarding international cooperation and the launching of the Interkosmos satellite is also included. Data on the launchings of the Kosmos, Molniya and Meteor artificial earth satellites are given in Tables. Author

N74-19633# Atomics International, Canoga Park, Calif.

AEROSPACE SAFETY PROGRAM: SUMMARY REPORT

J. M. Otter, K. E. Buttrey, and R. P. Johnson 30 Jul. 1973 353 p refs

(Contract AT(04-3)-701)

(AI-AEC-13100) Avail: NTIS HC $10.60

Projects in support of the Aerospace Nuclear Safety Program are summarized. The objective of the program was to evaluate the radiological safety of SNAP systems and to develop methods and designs to assure that safety. Projects summarized are analyses and experiments for determining: (1) the disintegration of reactors reentering the atmosphere; (2) the burnup of fuel elements reentering the atmosphere, including ablation and dispersal of particles; (3) reactor criticality conditions and the assurance of subcriticality in water; (4) the behavior of reactors in transient power operation; (5) the nuclear behavior of reactors on impact with the earth and in handling accidents; (6) the assurance of shutdown at the end of the power production lifetime; (7) risks by various exposure modes from different methods of reactor disposal; and (8) thermophysical properties of SNAP fuel materials. Author (NSA)

N74-19634# Science Research Council, London (England).

REPORT OF THE COUNCIL FOR THE YEAR, 1972 - 1973

1973 96 p

(NP-19867) Avail: AEC Depository Libraries HC $7.00; HMSO 73p; BIS $3.15

Scientific research is under separate headings: astronomy, space and radio; engineering; nuclear physics (including high energy physics and nuclear structure physics); science, other than that covered by specific headings (including neutron beam research and Atlas Computer Laboratory); materials science and technology (including superconductors). NSA

N74-19635# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).

DIVISION OF MECHANICAL ENGINEERING Annual Report, 1971 - 1972

1972 89 p refs

(NP-19878) Avail: AEC Depository Libraries HC $6.50

The nature and progress of research and information on current publications in the fields of engineering thermodynamics and fluid dynamics include data on controlled environment engineering (with particular reference to comfort cooling in tropical areas), stored products engineering (including heat and mass transfer processes), the utilization of solar energy, industrial fluid dynamics, and agricultural mechanization. The programs are closely associated with industry. NSA

N74-19636# Air Force Weapons Lab., Kirtland AFB, N.Mex.

AN ANNOTATED BIBLIOGRAPHY OF CIVIL ENGINEERING RESEARCH Technical Report, Dec. 1971 - Dec. 1972

Mary L. Foote Dec. 1973 26 p refs

(AF Proj. 683M)

(AD-771809; AFWL-TR-73-190) Avail: NTIS CSCL 13/2

Summaries of research reports concerning the effects of nuclear weapons on protective structures, advanced environmental pollution control, and conventional civil engineering research and development are presented. These summaries are from reports published by the Civil Engineering Research Division (DE), Air Force Weapons Laboratory (AFWL), from December 1971 through December 1972. For technical reports published by DE and predecessor organizations prior to 1971, refer to AFWL Technical Reports 72-17, 71-13, and 69-179. All reports are titled, An Annotated Bibliography of Civil Engineering Research. Research for these reports was performed in-house and on contract. Author (GRA)

N74-19128 Boeing Co., Seattle, Wash.

AEROSPACE TEST PLANNING AND CONDUCT DISCIPLINES

S. Baber *In* LMSC Proc. of Aerospace Testing Seminar 1 Jun. 1973 11 p (For availability see N74-19120 10-15)